PUBLIC WORKS

Founded in 1896

Devoted to the interests of the engineers and technical officials of the cities, counties and states

VOL. 72. NO. 3

A. PRESCOTT FOLWELL, Editor

MARCH CONTENTS

Published monthly by PUBLIC WORKS JOURNAL CORPORATION

Editorial and advertising offices: 310 East 45th St., New York, N. Y. J. T. Morris, *President*; Croxton Morris, *Treasurer*. *Advertising Manager*, Arthur K. Akers, 310 East 45th St., N. Y. *Advertising representatives*, Fred R. Jones, 228 No. La Salle St., Chicago, Ill.; Alonzo Hawley, 326 Bulkley Bldg., Cleveland, Ohio. Subscription Rates: United States and Possessions, Canada, Mexico and Cuba, $3.00. All other countries, $4.00 Single Copies, 35 cents each.

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The Editor's Page

Water Supply and Sewerage for Camps and Airports

Not the least important and difficult feature of the preparedness problem is that of providing a proper and adequate water supply for, and disposal of the sewage and refuse from, the scores of camps and airports throughout the country, each containing two to fifty thousand men. Ordinary communities grow gradually through a period of years, some methodically but most like Topsy, during which there is abundant time for collecting data and developing a water supply and sewerage system. But here we have thousands of husky men, with no women or children, suddenly placed as a compact community on an area where there was no community before.

The solution may take one of two forms—utilizing the facilities of a near-by city or providing them outright for the new community; and each presents its own difficulties and dangers.

Any water works superintendent can imagine what these would be if he were called upon to add 25% to 50% to his consumption on a few weeks' notice; and few sewage plant operators can imagine with equanimity the sudden similar increase in the quantity of the sewage which his plant is required to treat.

There are limits beyond which pumping, water purification and sewage treatment plants can not be forced without risk of calamity, and to attempt to do so is to endanger the health and lives of both the new community and the old, and possibly of others located on streams polluted by the overloaded sewage plant. No water or sewage official should allow himself to be persuaded to force his plant beyond the safe limit; and if he is required to do so he should, for his own protection, give the fullest publicity to his objection and the reasons therefor.

In perhaps the majority of cases the water supply, and especially the sewage treatment plant, must be provided especially, and here the headache is the designing engineer's. Data used for designing municipal plants can not be used without modifications in quantities per capita, in hourly rates, and in composition of sewage. The last will ordinarily be fresher, have a higher grease content and otherwise reflect the differences in food consumed by camp population as compared to the average family. There will be little or no non-domestic sewage, although in some cases the garbage may be ground and mixed with it. If the garbage is not so disposed of, some other means must be provided; and in any case the other refuse must be disposed of. At airports, elevated tanks and high chimneys probably will be prohibited.

To aid in designing such plants, PUBLIC WORKS in January published the Quartermaster Corps Instructions and Standards for camps and airports; in February, the recommendations by its consulting engineers to the War Department on the basic data for preparing such designs; and in this issue, typical designs for different types of airport sewage plants. Next month we expect to publish suggestions for the disposal of camp refuse.

Education of the Sanitary Engineer

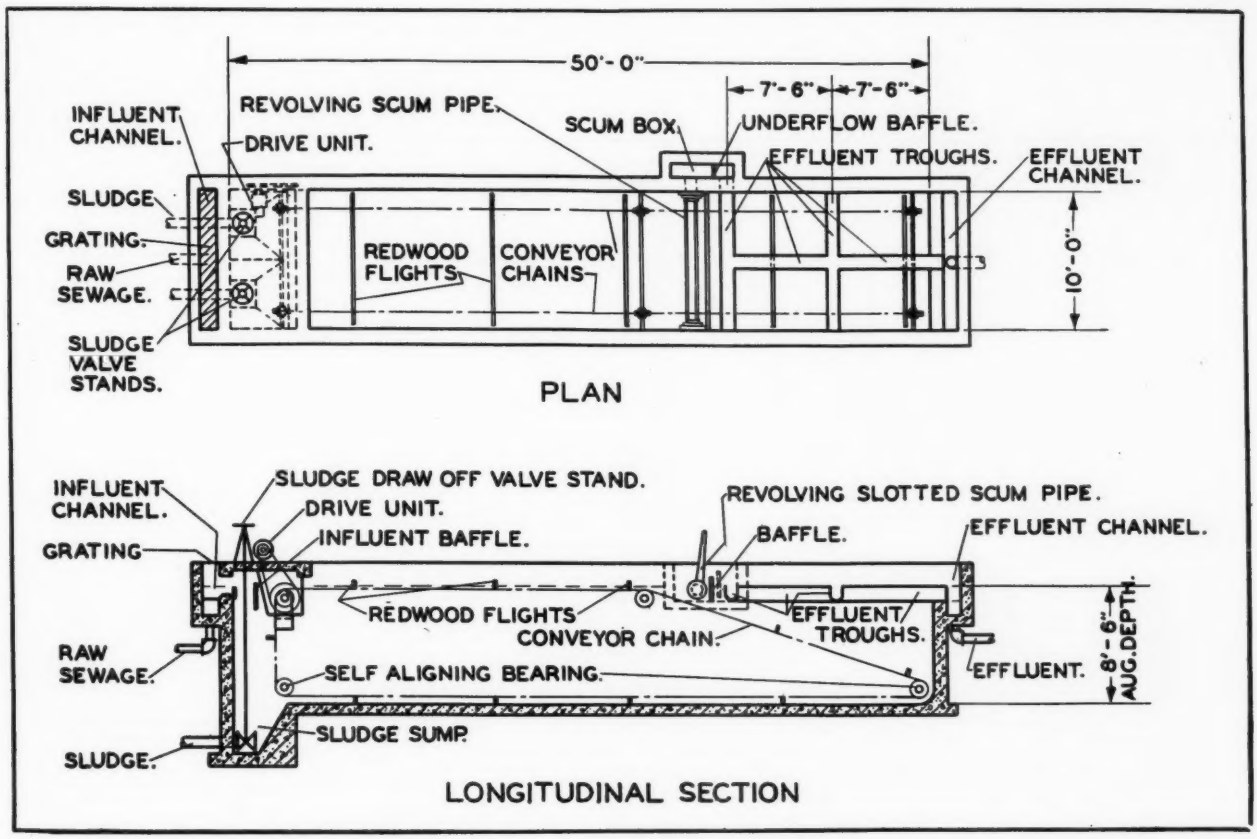
In the progress report of the Committee on Advancement of Sanitary Engineering submitted last October to the American Society of Civil Engineers, one of the prominent features dealt with was the academic education of the sanitary engineer. A sanitary engineer, the report states, should first be well equipped in general engineering. However, with respect to structures he is concerned with their functions rather than with the designing of the structure itself. These structures frequently involve the adjustment of chemical reactions or the behavior of bacteria under controlled conditions, and it is therefore essential that the training of the sanitary engineer include courses on sanitary bacteriology and sanitary chemistry. The treatment of water and sewage occupy such an important place in sanitary engineering that other phases of sanitation have received little attention; but a reasonably comprehensive curriculum should include instruction in the engineering aspects, the principles of design and the operation of equipment for the pasteurization of milk, the control of mosquitoes, rat-proofing of buildings, lighting and ventilation as concern health and comfort in the factory and elsewhere; the sanitary principles of plumbing, garbage and refuse disposal, smoke abatement and street cleaning. Altogether too often these problems are handled without the benefit of sound engineering study, design and supervision. These subjects are taught in other college courses such as mechanical and electrical engineering, but combined with so much that is not of immediate interest to him that an adequate course in sanitary engineering should provide instruction dealing specifically with the particular phases of these subjects that are of sanitary engineering concern.

More than most engineers, the sanitary engineer is engaged in contributing to the comfort or convenience of men as individuals of civic groups and should therefore have at least a basic understanding of epidemiology and vital statistics in order adequately to understand the reasons for and potential health protective value of works with which he is concerned; should have sufficient training in sociology and economics to be able to visualize his undertakings as a part of the social and economic structure; and should receive some instruction in the scope and limitation of the powers and the processes by which governmental agencies function. More general attention should be given to training in English, journalism and public speaking to enable him to exert a more potent influence on leaders in civic affairs and enhance recognition of his services wherever public interest is concerned.


Airport
Drainage Material

PUBLIC WORKS Magazine • • MARCH, 1941

VOL. 72. NO. 3



Primary sedimentation tank, with multiple effluent troughs, Jeffrey Mfg. Co.

Sewage Treatment for Airports

Plans for different types of treatment plants for a typical airport of about 2500 population

IN OUR February issue we published, slightly condensed, a report prepared by Metcalf & Eddy and Greeley & Hansen, giving recommendations for sewage treatment at National Defense Projects, including Army camps and air fields; and in our January issue, instructions and standards issued by the Office of the Quartermaster General of the War Dept. covering, among other things, the construction of sewage treatment plants at such projects. These tend to a certain extent to standardize such plants. However, local conditions have to be considered in each case, chiefly as determining whether complete treatment will be needed or only primary, and whether the project is located in a northern or southern climate.

The drawings herewith represent modern methods for the treatment of airfield sewage, based upon an assumed contributing personnel of 2,500 people, and upon the recommendations of the Metcalf-Eddy-Greeley-Hansen Report. In every state there are regulations, which have been prepared by the State Board of Health, governing the design of such installations, and these also must be followed, and before designing a plant the engineer should consult his State sanitary engineer. If he is not himself skilled in sewage plant design he should certainly consult an engineer who is.

In any case, the plant should include a measuring device, bar screens and sedimentation tank. Grit chambers will not often be needed. Secondary treatment may consist of trickling filters, either low-rate or high-rate, or activated sludge.

The Report gives as standard of quantity, 70 gallons per capita per day with a maximum for several

hours of 140 and a peak of 210 gcd; and of quality, 0.27 pounds per capita per day of suspended solids, 0.17 lb. of 5-day B.O.D., and 0.09 lb. of ether-soluble matter.

Sedimentation Tanks

The recommended capacity of sedimentation tanks, based on average flow, is 3.0 hrs. displacement period; 2.5 hrs. in case of high dilution of settled sewage without secondary treatment. The tank may be either rectangular or circular. The Chain Belt Co. gives the following design procedure for a rectangular tank:

Average flow = 70 x 2,500 = 175,000 gpd = 1,025 cu. ft. per hr. = 3,075 cu. ft. for 3 hours.

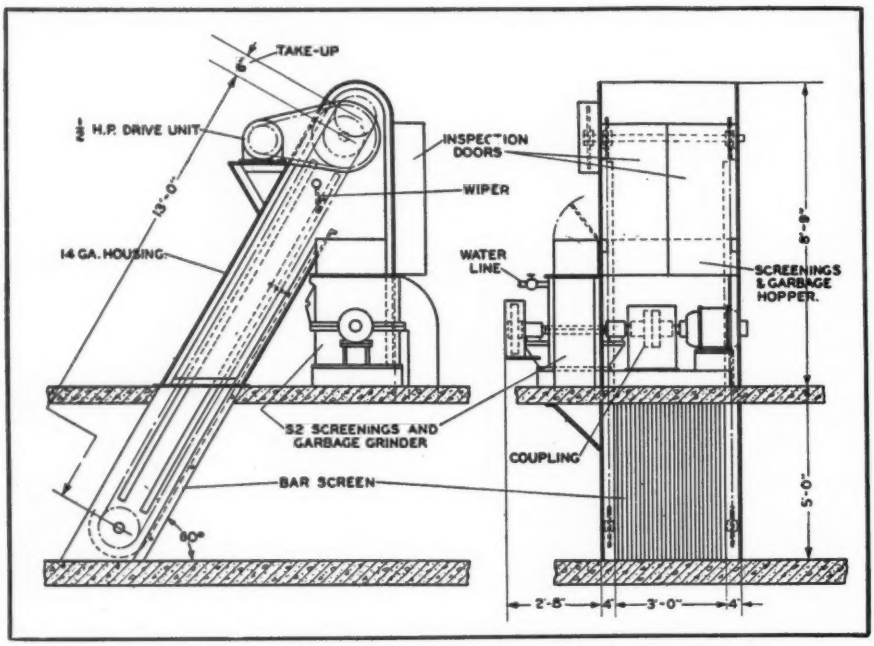
Assume 8′ average water depth. Then $\frac{3,075}{8} = 384$ sq. ft.

Use a tank 10′ wide by 39′ long by 8′ average water depth.

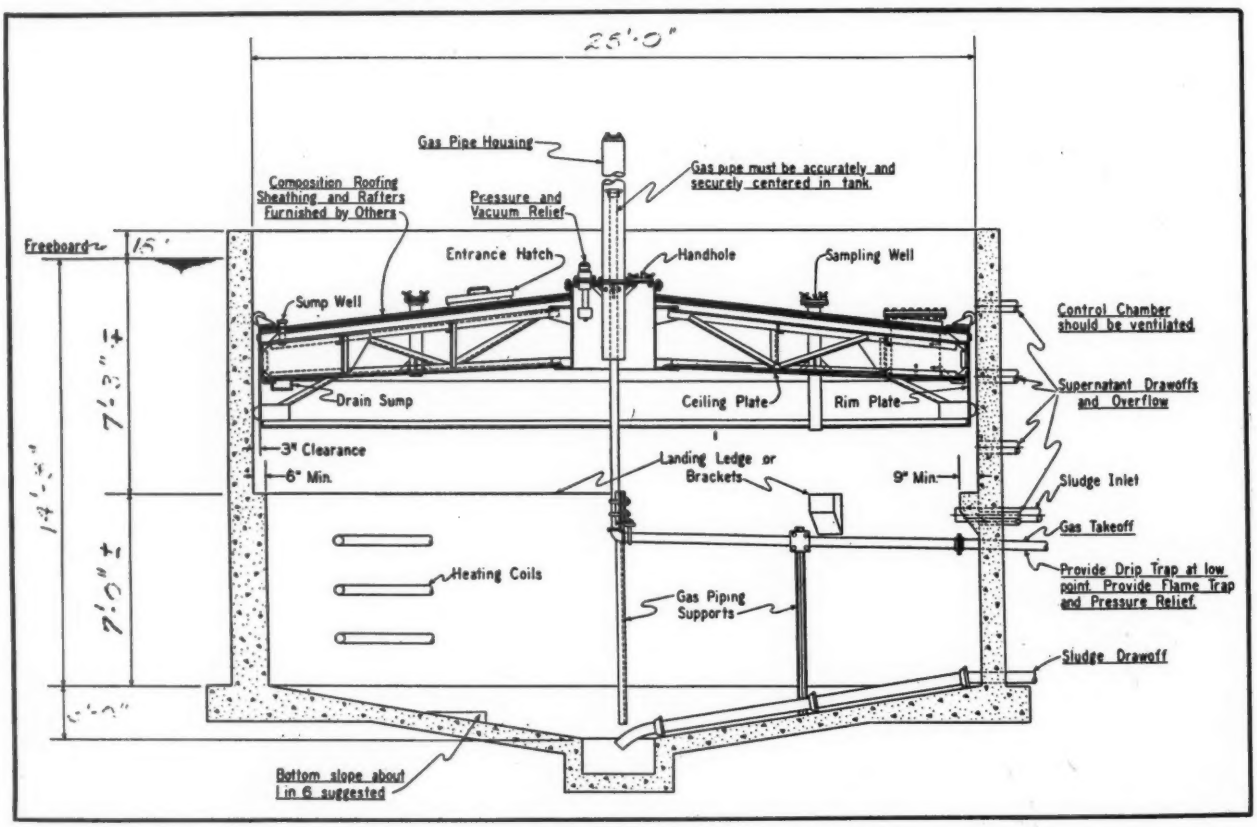
The Jeffrey Mfg. Co. recommends a tank designed on the basis of a population of 2,500 men with an assumed per capita flow of 100 g.p.d., giving an average flow of 250,000 gallons per day. The tank is designed to provide a two-hour detention period at average flow with an overflow rate of 1,000 gallons per square foot for 24 hours. This results in a tank of approximately 2,100 cubic feet capacity, and the tank which we have recommended would be 50 ft. long, 10 ft. wide, with an average water depth of 8 ft. 6 in.

The influent to the tank is by means of a cross influent channel and an overflow weir as noted. This channel is recommended so that this can be used not only to distribute the flow coming into the tank uniformly, but also to act as a small grit channel in case this tank is used for settling of sewage to which ground garbage has already been added. The grit could be removed from this channel (which would be covered with a grating) once every day or two and disposed of.

The last 15 ft. of the tank would be developed with overflow weirs as shown, which will give an overflow per foot of weir length of about 3,500 gallons per foot per day. Just before the last cross weir shown



Screen combined with screenings and garbage grinder, Jeffrey Mfg. Co.



Digestion tank with floating cover, Pacific Flush Tank Co.

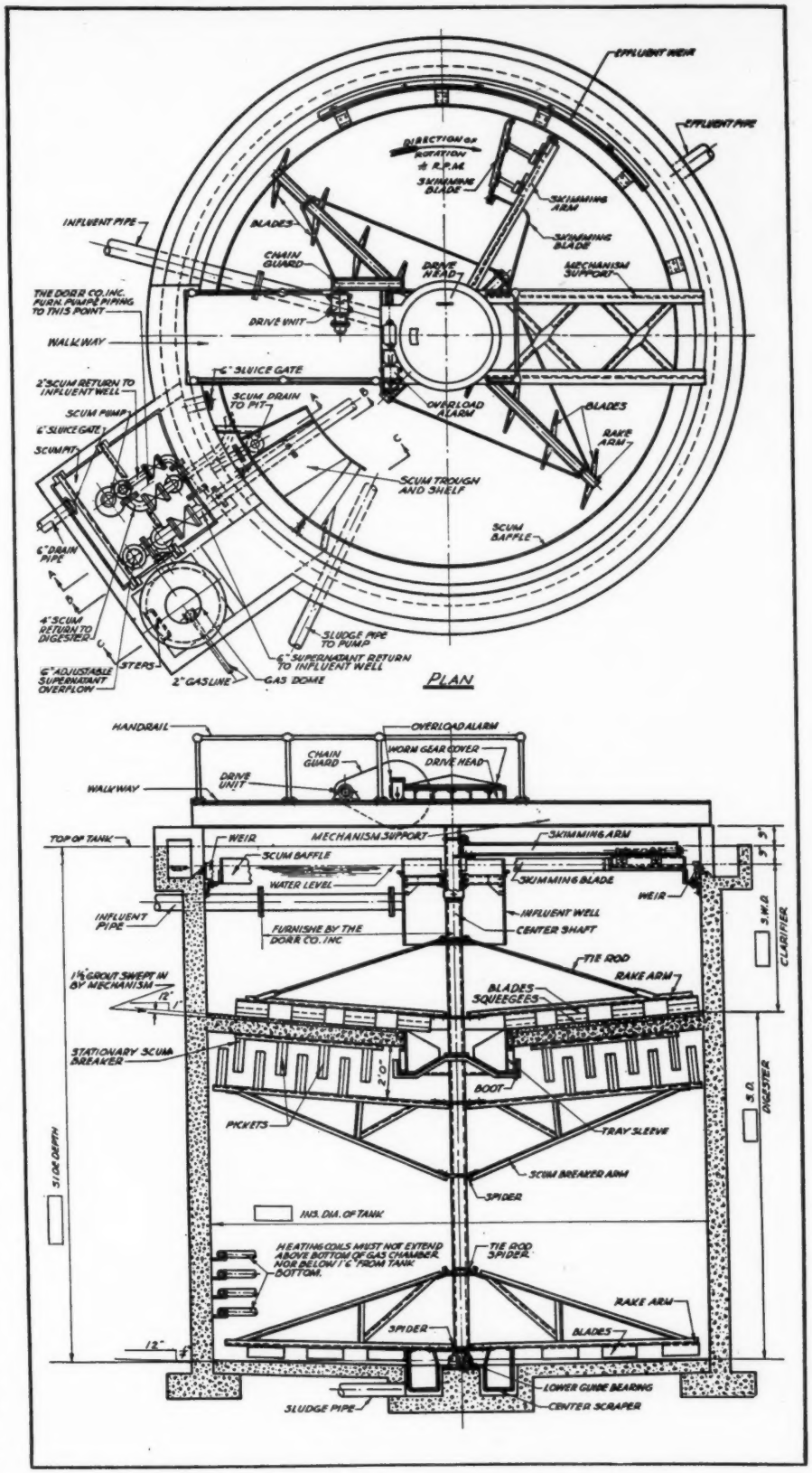
would be a baffle and in front of this a revolving scum pipe equipped with a handle which can be rotated into position to remove the scum periodically. The flights on their return run will carry the floating scum into the vicinity of the scum trough. The scum would then flow into a scum box adjacent to the scum pipe equipped with an underflow baffle so that the underflow would go directly into the effluent and the floating scum would be trapped on top of the box in front of the baffle. The scum would be removed from this box by hand whenever conditions warranted it.

The mechanism would be driven by a ½ horsepower motorized speed reducer. All bearings would be of the self-aligning type.

For a circular tank, The Dorr Co. recommends (in connection with a "Clarigester") for a flow of 200,000 gpd, one 28 ft. diameter and 7 ft. deep, giving 4,310 cu. ft. For 175,000 gpd, 24 ft. diameter by 7 ft. depth would give 3 hrs. detention.

Screenings and garbage may be ground and returned to the sewage for treatment. A screen for this purpose is shown of the chain and rake type, operated by automatic time control with devices provided for varying the periods between operations from once in two minutes to once an hour. The screen would be provided with two or more rakes and a limit switch would turn the mechanism off after making one complete cycle. The screenings would be removed by a wiper and deposited into a hopper at the head end of the screen. The entire screen above the floor line would be enclosed in a stream lined with 14 ga. galvanized housing.

The grinder shown combined with this screen is directly connected to a 25 horsepower 1,800 R.P.M. motor. This grinder would be used for disintegrating either screenings or garbage. The screenings or garbage would be fed to the grinder manually a few times a day by opening the access doors in front of the screen and raking the material into the grinder. The electrical control for the grinder would consist of a manually operated switch. Flushing water for the grinder would be turned off and on manually. If garbage is added to the sewage the capacity of the plant must be increased accordingly.



Sedimentation and digestion combined: The Dorr "Clarigester."

Digestion Tanks

In designing a sludge digestion tank for an airport of 2,500 personnel, the Pacific Flush-Tank Co. uses 3,000 to allow for possible increase, and provides a capacity of 2.5 cu. ft. per capita. (The engineers' report recommends 2.0 to 3.0 cu. ft.). This gives a

(Continued on page 40)

Otto C. Gohlke

Designing a Drainage System

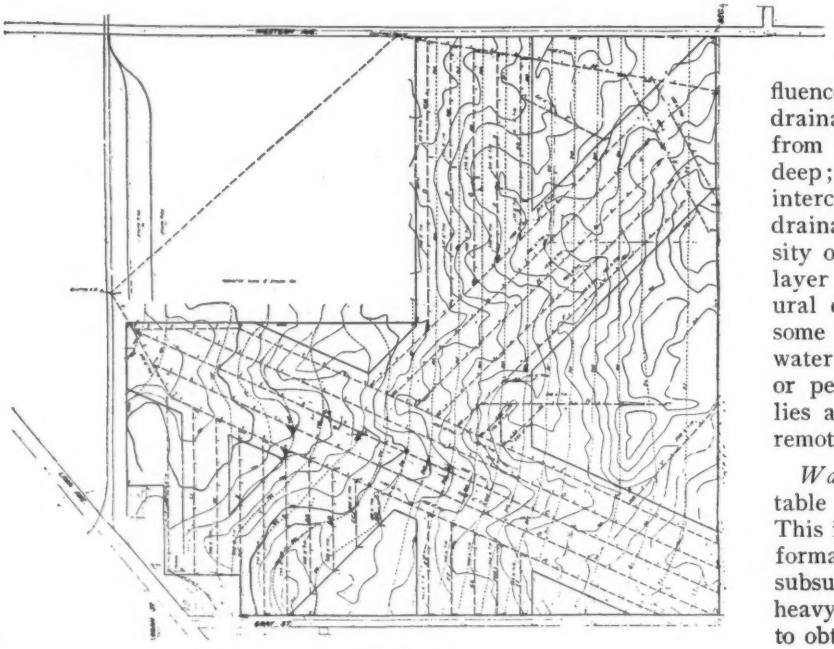
By OTTO C. GOHLKE
City Engineer, Findlay, Ohio

THE most important function of an airport, according to pilots and airport managers, is the safety with which a plane can be landed. To obtain such safety, many factors must be given consideration. One of the most important ones is adequate drainage. Landings must be made in all seasons and in all kinds of weather, and in designing and building an airport, safety must be provided, so far as possible, for all of these conditions. In planning drainage, the following steps, as used in designing the drainage system of the Findlay airport, may be followed:

Mapping.—A topographical map of the airport area should be prepared, showing contours on intervals of 1 or 2 feet. The runways are laid out on this and the natural drainage slopes are considered. In the case of the Findlay airport, it was found that the longest runway lay along the natural drainage slope of the area, and it was planned to place a trunk drainage line on either side of this runway area, with the laterals from the remainder of the field draining into these two main lines. The contours, and the layout of the runways, along with the elevations of the final surface afford necessary data for general drainage system design. Details of design, however, are influenced also by other factors.

Surface Study.—A study of surface conditions is important because these not only affect surface drainage but are often a key to subsurface needs. Elevations should be noted, and the character of the material of which they are composed. Sink holes and seep areas, or places where water stands either continuously or in wet seasons, should be studied. The surface soil is important unless excavation is required to such an extent that the original surface will be entirely removed. Low places may require additional surface drainage installations, and may permit or require the installation of catch basins. In this connection, careful attention should be given to adjoining surface conditions, including the probabilty of storm water discharge onto the airport area and possible provisions for this.

Subsoil Studies.—Careful consideration of subsoil conditions is essential and a thorough examination of subsurface formations is necessary. The density, firmness and character of the subsoil should be noted, and a log of the various formations should be prepared for the entire field; that is, to show the conditions for all types of soils that exist throughout the airport. The types of subsoil influence greatly the need for subsurface drainage. Clay or silt soils may raise water from an underground source many feet deep; but a layer of porous material will intercept the flow. The desirable depth of the drainage system will be affected by the density or type of the soil. An impervious soil layer near the surface prevents quick natural drainage; an impervious soil layer at some depth may result in a high ground water level, either temporarily after a rain or permanently. An impervious layer that lies at an angle may bring in water from remote areas, causing wet spots.



Contour map of Findlay airport area.

Water Table.—The elevation of the water table should be determined for all seasons. This information, with the log of the subsoil formations, permits final planning of the subsurface drainage. At Findlay, due to heavy pumping from quarry pits and wells to obtain water for industrial use, the water table was some 40 feet down and therefore

for a Modern Airport

General principles employed in designing the drainage system for an airport—mapping, studies of surface, subsoil and water table, rainfall and temperature data

View of Findlay airport.

of little consequence. However, because of the possibility that conditions might change, resulting in a raise of the water table level, the depth and size of the pipe were increased.

A high water table and the presence of silt or clay necessitate the use of drain tile lines at close intervals in order to intercept the water and prevent it from reaching the ground surface.

Rainfall Data.—Rainfall is important in more ways than one. Intensity of rainfall fixes the sizes of the sewers that must be provided and the spacing of the tile drainage lines. The total amount of rainfall, the influence of season, and the frequency of spacing of rains are all factors. Much rain concentrated in a relatively short period means that the ground will be saturated; special provisions must therefore be made both for quick removal of surface water and for adequate subsurface drainage. Subdrains may be spaced more closely; also since the ground is normally wet during these rainy periods, the proportion of rainfall that runs off will be greater.

Temperature.—Low temperatures affect drainage design in that if the ground is frozen when rain falls, practically the entire rainfall runs off; also the system must be designed to effect complete removal of the water before it freezes on the runways or elsewhere on the ground. High temperatures hasten the evaporation of water from the upper layers of the soil and reduce the amount that must be removed by the drainage system.

These general principles were employed in the design of the drainage system for the Findlay airport, Extra Quality ASTM drain tile being used throughout. Six years of operation of this airport has proved that care and thoroughness in the construction of the drainage system are necessary for uninterrupted operation and essential to low maintenance costs.

Larchmont, N. Y., Remodels Rapid Sand Installation of Porous

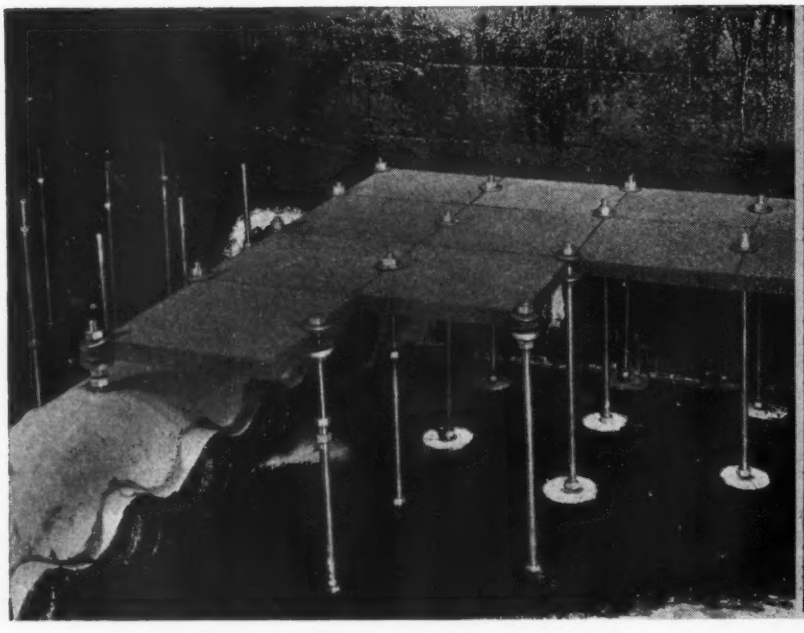
Description in detail of how the old rapid sand filter of this city, using gravel support for the sand, was changed by eliminating the gravel

By HENRY T. HOTCHKISS
Supervising Chemist

A SUFFICIENT number of causes of poor performance of rapid sand filters have been disclosed to justify a critical study of any system which claims to eliminate most of them. One of the great difficulties has been to maintain sand and gravel layers at their proper levels in the filter box. Considerable research has been made to determine the most ideal sand size for effective filtration of water, and the relation of the sizes of successive gravel layers to support the sand. After the selection of the materials, extreme care has been taken in placing the filtration medium in the box. However, during periods of service, it is found that successive backwashing operations lead to displacement and the necessity of rebuilding sooner or later. As John R. Balis states[1] "The process of rebuilding filter beds is expensive in some plants, for it has to be done almost every year." Whenever, sand and gravel must be removed, regraded and replaced, the procedure is costly. Consequently there is the tendency to delay until the condition is bad and filter efficiency poor. This gradual loss of efficiency is a serious indictment of the conventional filter.

A proposal by Prof. T. R. Camp[2] to support filter sand directly on manufactured porous plates, forming a false bottom, followed experiments and tests conducted with Rolf Eliassen at Providence, R. I.

The elimination of the deep gravel layer is a fundamental step in the improvement of filter design. The usual procedure in filter construction is something like packing a box with a layer of grapefruit in the bottom, followed by a layer of oranges, then limes, then grapes and peas and at last covering over with barley. After packing in this metastable condition, the box is subjected to handling, with no regard for the label "keep this end up." When the contents are examined with the expectation that no barley has sifted down among the grapefruit, disappointment occurs. Coarse gravel layers are not easily displaced in backwashing a filter, because the lifting velocities required are abnormal. However, hydraulic



Method of supporting plates on Everdur studs.

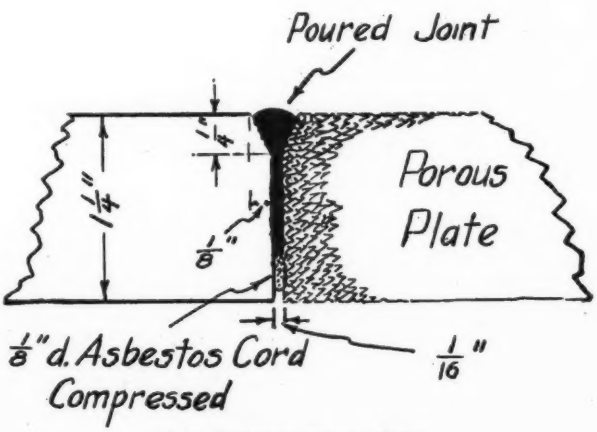
A deflecting baffle plate over manifold outlets.

Filters by the Plate Bottoms

Sand is placed directly on false bottom of porous plates.

grading of the sand itself is far from perfect, as indicated by the studies of Thomas Riddick[3] and experience has been that there is a mingling of the finer gravels with the sand, even in what may be considered well designed filters.

A number of porous plate filter bottoms have been installed and described in some detail[4]. The results obtained with one unit described by the author[5, 6] have been sufficient to undertake the reconstruction of three additional filters. This work is now in progress. One new unit is completed and placed in service before dismantling another.



Joint between porous plates.

Installation Details

It is proposed to outline here the method of installation in sufficient detail to show how the job was done, with particular notations on detail changes made to secure a better finished job.

After cutting a filter out of service, all sand was screened with the aid of water and pumped to a storage pile ready for replacement. The gravel was discarded. Laterals, which were found considerably corroded and with numerous orifices plugged with rust incrustants, were removed from the 10-inch cast iron manifold header extending across the center of the bottom of the box. The concrete walls were cleaned and the manifold and wash troughs scraped. The wrought iron gutters and baffle plates were treated with a prepared phosphoric acid inhibitor "Rustarest" followed by a red alkyd primer and finished with "Korosist" quick drying enamel. The exposed concrete from the leval of the wash gutter lip to the top of the box was painted with the gray enamel, while the rest of the box and the cast iron fittings which could be reached were coated with No. 5 Insulectric Black. Prior to painting the bottom slab, 1¾-inch holes were drilled to receive the bushings into which the plate-supporting studs would be inserted. These 1-inch diameter bushings, 2½ inches long were knurled on the outside to develop bond with the cement which held them in place. During the setting period the studs were held in position by wood templates carefully laid out to bring each supporting member to its proper location. In this way all studs were in position before any plates were installed. The manifold was drilled and tapped to take one row of short studs and the baffle plates were secured in place. All the fittings were of "Everdur" metal. Each stud was locked to its bushing by a hex nut. At the upper end of the ⅝-inch diameter stud, threaded on both ends, a hex nut was run on, followed by a 2-inch diameter (⅜-inch thick) washer and a 2-inch diameter (3/16-inch thick) No. 95 commercial grade sponge rubber washer. After placing the plates, another rubber washer was held under a 2-inch (5/32-inch thick) metal washer and a final hex nut. The plates were leveled row by row using these adjusting nuts.

Setting the Plates

Guided by previous experience in forming the joint between plates, the upper edge of each Norton plate was formed with a rabbeted edge, ⅛-inch wide by ¼-inch deep, by the manufacturer. To seal the butt joints at the bottom, a ⅛-inch asbestos cord was drawn from stud to stud on each side as the plates were slipped into place. Before the last plate in each row was set the cord joints were compressed by forcing the plates together by the lateral pressure of a small hydraulic jack. The final clear opening between plates was thus reduced to approximately 1/16 inch. Then two plates locking the row were pressed into

position in a manner similar to closing two cupboard doors simultaneously. When the entire false bottom was thus installed, the upper washers were removed temporarily and asbestos cord was wrapped around the studs projecting up through the joints. Then all joints were poured with hot plastic "self-healing bridge cement." Here a gadget was invented which made it possible to do a neat and efficient job. The end of a small aluminum funnel was constricted to give an opening about 1/16 inch diameter. An electric soldering iron with a ½-inch copper point was set inside the funnel and tied loosely to the rim with a copper wire. The joint material was kept hot in a kettle and transferred to the funnel as required, while the hot iron prevented the chilling of the bitumastic while running the joints. Loss of hot plastic through the joints was prevented by the asbestos dam at the bottom of the joint. The groove formed by the bevel on the adjacent plates made a suitable channel to finish off the surface. The washers and nuts were replaced and drawn up tight. The wall joints were then made up. To cope with the unevenness in the concrete walls either the plates may be chipped or the walls recessed. The latter seems preferable. With the bottom completed, the next step was to test it with the maximum wash rate available, in inches rise per minute. After draining, the sand was sluiced back in through a final screen, the sand sterilized with hypochlorite, washed thoroughly and then the filter was placed back in the line ready for service.

It might be noted here for emphasis that no attempt was made to grade the sand. A certain amount of hydraulic grading does take place during the backwash, but since the pore size and the passages of the porous plate will not permit the loss of sand it would seem logical to utilize, if possible, sand of uniform size within the range of efficient filtration. This type of bottom should lend itself to pressure filter fabrication, whether to retain sand, zeolite or granular carbon. The ease with which the filtering medium could be removed and the plates taken out if necessary to expose the entire inner shell will appeal to the operator of this type of equipment.

The renovation of the purification plant has been undertaken with the sympathetic approval of Commissioner Arthur H. Loucks, representing the Board of Trustees of the Village of Larchmont. Helpful suggestions from the executive Engineer, Arthur Richards, have contributed to the success of the work and are gratefully acknowledged.

(1) Water Wks. Eng. *93* 1404 (1940).
(2) J. New England Water Wks. Assn. *49* I (1935).
(3) J. Am. Water Wks. Assn. *32* 121 (1940).
(4) See L. R. Stevens, Water Wks. and Sewerage *87* III (1940), also discussion H. T. Campion, J. Am. Water Wks. Assn. *32* 500 (1940), F. E. Stuart, private paper p. 12 reprint Florida Sec. A.W.W.A. May (1940).
(5) Water Wks. Eng. *92* 1426 (1939).
(6) Water Wks. and Sewerage *86* 442 (1939).

Excavating Rock in Sewer Trenches

In building a sewerage system and treatment plant for the village of Hillsboro, O., population about 5,000, rock was found near the surface in most of the trenches. This was mainly limestone, but varied greatly as to stratification and hardness. Quite a little of it was asphaltic limestone containing up to 3% bitumen, which was difficult and expensive to drill and excavate, but served as excellent material to replace on top of the backfill.

Where there was not much rock a ¾ yd. trench hoe was used. Where drilling was necessary, the rock was stripped with a ½ yd. trench hoe. For drilling, there were used eight compressors, one 105 cu. ft., five 160 cu. ft. and two 510 cu. ft. Holes were drilled under a number of different plans—at different intervals, staggered and straight, and at different angles, but the best results were obtained by drilling vertical holes 3 ft. deep spaced 20″ on centers, in the center of trenches which were not over 30″ wide, but in pairs opposite each other 6″ from the sides of the trench for wider trenches. These were loaded on the average with 1½ to 2 sticks of 1¼″ of 40% dynamite and shot separately.

A number of kinds of blasting mats were used in trench blasting, but the best protection was obtained with one designed by C. G. Duval, WPA superintendent on the job. This mat was constructed of ½ inch sheet steel, 4 feet wide and 15 feet long, reinforced with four 4″ I beams, electrically welded longitudinal to the bottom of the sheet. Swinging aprons of sheet steel 2 ft. wide and 4 ft. long were hinged on each end, which could be swung down in the trench at the time of blasting. There were two pipes, one on each side of the mat, hinged to the mat and also attached to an axle supporting two wheels on the outside of the mat. The pipes acted as levers and were hinged to the mat slightly off-center, thus permitting two men to pull these levers to a horizontal position, and in so doing, support the entire mat on the two wheels.

Provision was made to latch these levers horizontally which would permit the mat to be moved on the wheels along the trench with very few men. When blasting, the levers were released and the 4″ I beams allowed to rest directly on the ground. In some cases where the trench was exceptionally wide, planks were thrown across the ditch under the mat to keep it from falling in the trench on account of a very heavy blast. This mat was used in blasting approximately 20,000 cu. yd. of trench rock and not a single fatality occurred.

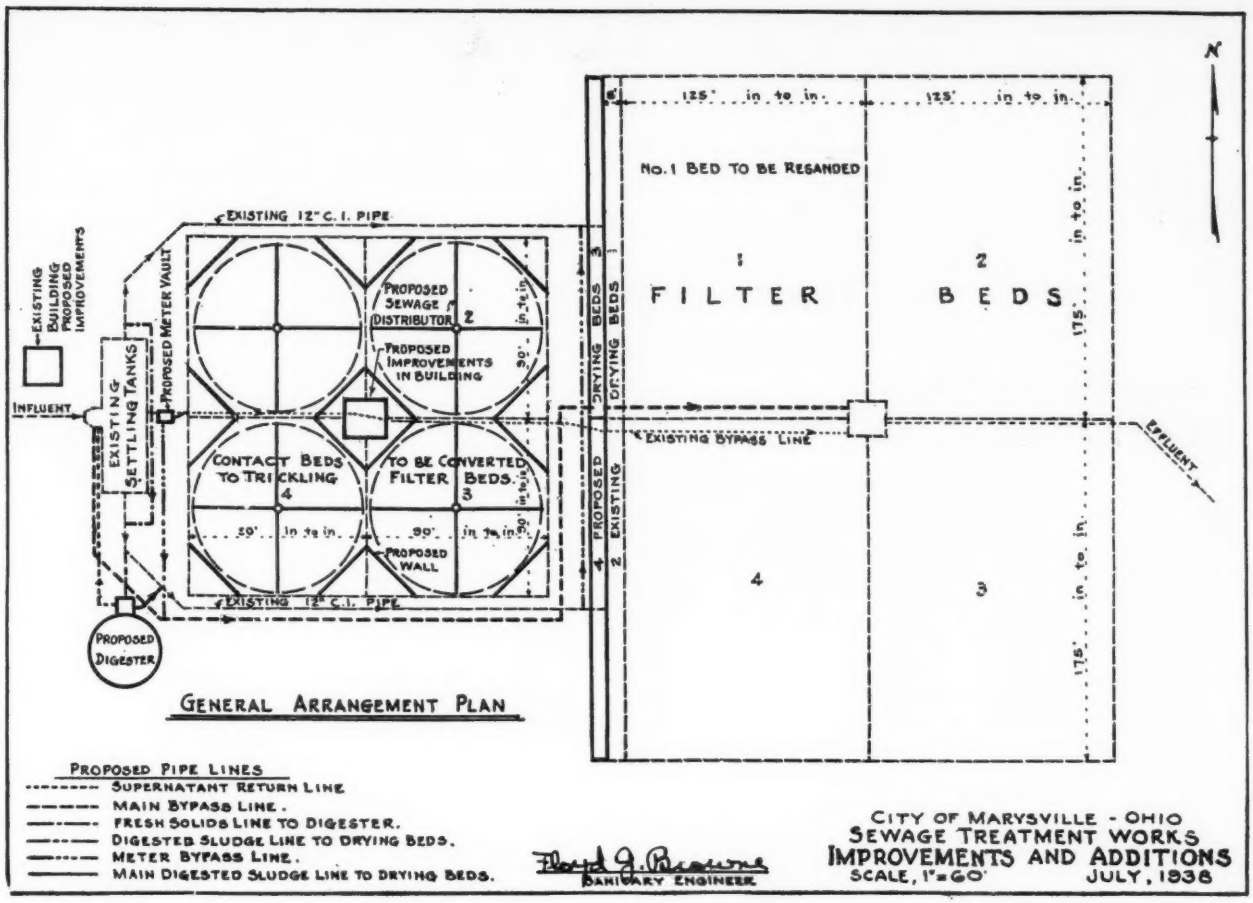
W P Aid for Danville Public Works

By ROBERT C. TERRELL
City Engineer, Danville, Ky.

DANVILLE, Ky., has benefited greatly by WPA assistance in the past, and plans for considerably more work work this year, including curb, gutter and sidewalk construction and oil asphalt retread surfacing; also $80,000 of sewer construction and a $120,000 treatment plant.

In the street work the city furnished certain equipment, truck drivers and a few key men, and the cement, sand and form lumber, which are billed to the property owner; most of the labor is WPA. On two streets, which are quite important highways, construction of curb and gutter and roadway surface is planned for which the State will furnish the materials, the City the truck drivers and equipment, and WPA the labor, oil and gas, and curb forms.

In constructing sewers, the pipe, cement, sand, tops, covers and brick for manholes are furnished at the expense of the property owner; most of the labor by WPA. The treatment plant will be financed from water revenue bonds, on the principle that the water department, having brought the water into the city, should return it to as nearly its original condition as possible. Owing to the great amount of machinery in the plant, the city's portion of the cost will be about 65%, and the labor and material furnished by the government 35%. It is believed that the income of the water department will suffice to carry these bonds without raising the water rates.



General plan of Marysville Sewage Treatment Works.

Treating Milk Wastes by Two-Stage Filtration

How the old Imhoff contact bed-sand filter plant of Marysville, Ohio, was changed over to a settling tank-trickling filter-sand filter one, and the success of the latter in handling milk wastes

By Earl F. Wittmer

of Floyd G. Browne & Associates

MARYSVILLE, Ohio, about 30 miles northwest of Columbus, has a population of slightly over 4,000, of which 3,600 are connected to its sanitary sewer system. In addition, the sewers serve the State Reformatory for Women with about 600 population, and receive wastes from a milk plant handling about 500,000 pounds of milk a day, which has a population equivalent of from 29,000 persons to 12,000, with maximum concentration between 9 a. m. and 5 p. m.

During the year 1939 the sewage treatment plant, which had been unable to handle this load satisfactorily, was remodeled at a cost of $41,000, including PWA assistance. The original plant had been designed to handle 480,000 gpd, using bar screens, two Imhoff tanks, four contact beds containing 32,400 sq. ft. of stone 4 ft. deep, four intermittent sand filters with 2 acres total area, and two sludge drying beds. In the remodeled plant the Imhoff tanks are used unchanged as settling tanks giving 2 hr. detention, from which the fresh solids are pumped to a digester 35 ft. in diameter with floating cover and capacity of 2.3 cu. ft. per capita. The area of the open sludge drying beds was increased to 5,600 sq. ft.

The four existing square contact beds were converted into octagonal trickling filters by building walls across the corners, and the stone originally in the corners was spread over the top of the remainder (which was not disturbed), increasing the depth from 4 ft. to 4½ ft. and giving a total area of 26,600 sq. ft. and total volume of stone of 4,430 cu. yd. No change was made in the underdrains except to connect several vents thereto. No change was made in the sand filters except to resand one.

The purpose of this paper is to discuss the results obtained with this plant. Samples were taken hourly from May 15 through September 11 and daily composites were made in proportion to the flow. Dissolved

Trickling filters, Marysville sewage treatment works.

oxygen, 5-day B.O.D. at 20°C, pH, and methyl orange alkalinity determinations were made immediately after collection on the hourly samples. Suspended solids, total solids, nitrite, and nitrate, determinations were made on the composited samples. All determinations were made according to "Standard Methods for the Examination of Water and Sewage." A total of approximately 1,350 determinations were made in all. The figures and averages given in this report cover the period from 9 a. m. to 4 p. m. only.

The average maximum rate of flow, 0.810 m.g.d., and load in pounds of B.O.D., was found to be at 3 p. m. The average minimum rate of flow and load in pounds of B.O.D. for the test period was at 9 a. m.

Sand filters at Marysville.

5-Day B.O.D. at 20° C. Obtained from Average of Hourly Samples

		% Reduction	
		By stages	*Total*
Raw sewage	580 p.p.m	...	...
Settled effluent	439 p.p.m.	24.3	24.3
Filter "A", first-stage filtration	142 p.p.m.	67.6	75.5
Filter "B," second-stage filtration	56 p.p.m.	60.6	90.4
Final effluent	20 p.p.m.	64.3	96.6

These figures reduced to pounds of B.O.D. removed show that, on the average, Filter "A" removed 30.9 pounds B.O.D. per 1,000 cubic feet, and Filter "B" removed an additional 8.9 pounds B.O.D. per 1,000 cubic feet during the test period.

In terms of acre-feet, Filter "A" removed 1,350 pounds B.O.D. per acre-foot per day, and Filter "B" removed 390 pounds B.O.D. per acre-foot per day.

Total Filter Loadings, Removals, and Filter Efficiencies

Filter Loadings
- Filter "A" ..... 2740 pounds B.O.D. per day = **1.23** pounds B.O.D per cu. yd. per day
- Filter "B" ..... 886 pounds B.O.D. per day = **0.4** pounds B.O.D. per cu. yd. per day

Filter removals
- Filter "A" ..... 1855 pounds B.O.D. per day
- Filter "B" ..... 537 pounds B.O.D. per day

Filter efficiencies
- Filter "A" ..... 67.6 per cent
- Filter "B" ..... 60.6 per cent

During most of the period in which this group of tests was made, there was a very heavy sloughing of solids from the trickling filters. In addition to the usual sloughing of solids from the treatment of concentrated wastes, a large part of the slough came from the extremely dirty contact beds, which had been used as contact filters for several years before the conversion. This heavy unloading of solids brought about a serious problem in the operation of the sand filters. This was partially overcome by using one of the sand filters as a settling basin, and allowing the effluent to spill over onto the other sand filters. A study of the suspended solids data will show clearly the extent of the sloughing:

	Average Total Solids	Average Suspended Solids *Present*	*Percent Removal*
Raw sewage	1,206 p.p.m.	360 p.p.m.	...
Settled effluent	1,063 p.p.m.	143 p.p.m.	60.3
Filter "A" effluent	968 p.p.m.	206 p.p.m.	42.8
Filter "B" effluent	1,027 p.p.m.	146 p.p.m.	59.4
Final effluent	853 p.p.m.	29 p.p.m.	91.9

Due to the entrained solids moved, no comment can be made regarding any reductions in soluble solids.

Average Rate of Sewage Flow

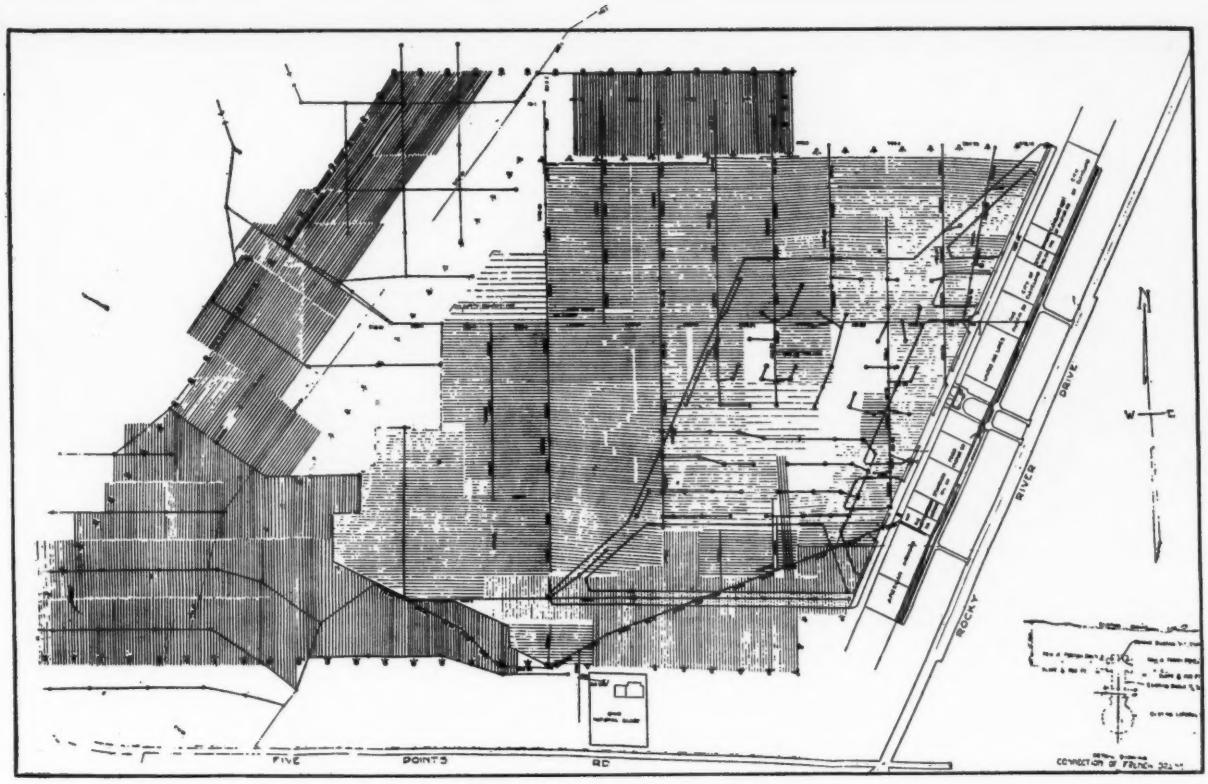
9 a.m.	0.550 m.g.d.	1 p.m.	0.803 m.g.d.
10 a.m.	0.674 m.g.d.	2 p.m.	0.804 m.g.d.
11 a.m.	0.760 m.g.d.	3 p.m.	0.810 m.g.d.
12 n.	0.796 m.g.d.	4 p.m.	0.792 m.g.d.

Control building, settling tanks and digester.

There is little to be said regarding methyl orange alkalinity and pH. A great variation in each was encountered. The limits during the tests were as given in the table.

With the filter loadings unusually heavy, any nitrification from Filter "A," the so-called roughing filter, came as a surprise. Filter "B" showed a rather high rate of nitrification, being higher during the heavier

(Continued on page 37)



Drainage system at Cleveland airport.

Airport Drainage and Subdrainage

A Primary Requisite, Second Only to Approaches, Is Adequate Drainage for the Entire Airport Area, Both Surface and Subsurface.

By MAJOR JOHN BERRY
Cleveland Municipal Airport, Cleveland, O.

A DETERMINATION of the artificial drainage requirements, both surface and subsurface for an airport, calls for a consideration of the following factors individually and also of their occurrence in various combinations:

(a) A topographical map showing the complete contour of the surface.
(b) Character and arrangement of soil and subsoil strata.
(c) Data on soil water, both capillary and free (including elevation of present water table).
(d) Amount frequency, intensity, duration, and season of occurrence of heaviest rainfall.
(e) Temperatures.

In general, the drainage system required to remove the surface water from an airport is similar in character to the storm-water system of ordinary municipal practice; whereas the removal of subsurface water involves also the application of farm drainage for all intermediate areas. Laterals for subdrains should be placed no farther apart than 25 feet on centers, with a porous back fill which is designed to accomplish two purposes: 1. Quick drainage of all surface water; and (2) To intercept and lower the water table in order to reduce and control capillary water.

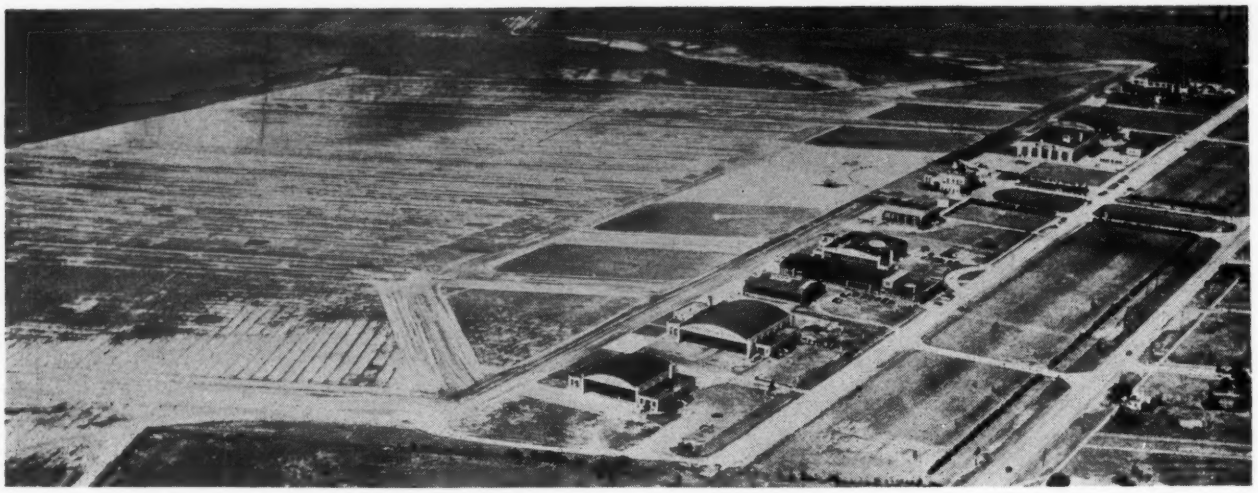
The design of such a complete drainage system should be based on data obtained from the following:

1. A determination of operating needs which will include a study of all the areas to be drained with a definite decision as to the depth of the water table which can be permitted to accumulate at any point at any time, without endangering landing surfaces.

2. A study of the rainfall characteristics of the region or territory where the airport is to be built. This should include rainfall curves and frequency factors. The intensity of rainfall for which the curve should be drawn will depend on the character and importance of the proposed structure. The result to be obtained in airport drainage is to remove the water at the quickest possible time with the lowest workable water table. In some cases the lowering of the water table will depend upon satisfactory outlets.

3. The mapping of soil profiles and a study of them in connection with, and for the purpose of, determining the expected run-off from both paved and unpaved surfaces. This will require not only a study of existing soil conditions, but also a consideration of the plans for the development of the landng area and the amount and kind of coverage to be employed.

4. Preparation of final airport plans. It is essential for a preliminary drainage design that the ulti-



Airplane view of the airport of Cleveland, Ohio.

mate plan of development of the airport be determined. The amount of run-off and the extent and location of each area of different run-off must be accurately known.

5. Preparation of a finished grading plan. Such a plan showing all elevations and surface slopes is necessary in the establishment of the storm sewer grades.

Determination of run-off and design of storm-drainage systems require extensive experience and should be entrusted only to a trained and experienced drainage engineer.

Subsurface Water Removal

The term subsurface water includes both free water and capillary water. Free water is the water in the ground that is free to move under the influence of gravity and can be removed therefore by drains. Capillary water, which exists as a fringe of variable thickness above the water table, is able to move in any direction and cannot be removed by drainage. It can, however, be controlled by lowering the water table through the removal of free water or by cutting off the water sources from which it is fed.

In general, the data required for the design of a drainage system for the removal of subsurface water from airports is the same as that required for the design of the system for removal of surface water. However, particular emphasis should be placed on the mapping and study of the soil conditions and the location and seasonal variations of the water must be given special consideration.

A trench that is back-filled with a porous material serves a threefold purpose, acting as an inlet for surface water, as a storm drain and as a subdrain. In order that water may be collected from a uniform plane surface, such as an airport surface, some form of continuous inlet must be used. Thus the conventional type of subdrain may be modified and adapted for the removal of storm water, though, being a subdrain, it also removes subsurface water.

The design of the drainage system, as regards capacity of the discharge outlet and of the principal laterals, thus depends upon the amount of storm water to be removed and the familiar methods for computing storm water runoff are used. The demands of storm water removal are met by installing pipes that are large enough to remove the maximum designed rainfall; and during periods between rains, these pipes, and the drain laterals emptying into them, act as subdrains to remove ground water. No extra capacity is allowed for carrying subsurface water; and, in actual practice, the storm drainage system may not be designed to remove the storm water resulting from the heaviest rainfalls. As in municipal storm drainage, it may be economical to design only for the heaviest rainfall normally expected in one, two or five years, and not for the maximum 15, 20 or 50-year storm.

Drainage of Cleveland Airport

A study of such pertinent factors resulted in the present drainage installation at Cleveland Airport. This installation consists of two main outlets over 6,000 feet in length. At the upper end these are of 24-inch vitrified pipe and the lines increase to 60 inch at the outlet, where concrete pipe is used. Into these main outlets, laterals of 15 inch and 18 inch vitrified pipe were installed on 400-foot centers. The length of these laterals approximated 30 miles.

Into each of the 15 inch and 18 inch laterals, drain laterals of 4 inch Extra Quality drain tile, backfilled with cinders and slag, were installed on 20-foot centers. This installation of drains involved the laying of considerable more than 1,000,000 feet of Extra Quality drain tile.

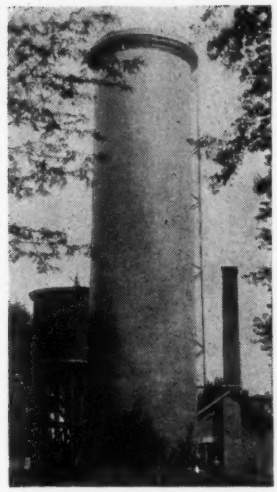
Through this type of drainage a firm and dry field is assured at all times. The surface water resulting from a storm is removed promptly, and before it has an opportunity to soften the ground surface. Also the ground water table is kept at such a level that there are no soft places caused by ground water, and heaving and frost boils also are prevented. The drainage of the intermedite areas between the runways is of the utmost importance, and in the case of the Cleveland Municipal Airport, it has been so successfully accomplished that even the heaviest planes using the airport can land in safety, if necessary, on any part of the field; and even after fifteen years of operation there has been no lessening in the efficiency of the type of construction that has been described.

Experience has shown that thorough tile drainage is the most important factor in the construction of any airport. Such drainage, by lowering the water table and intercepting capillary water, maintains a firm and usable intermediate area and also prevents frost damage to runway surfaces through improper subdrainage. Highway engineers have been taught by experience that inadequate drainage is the most costly factor in road maintenance and the same is true of airports.

Development of De Kalb's Water Works

How an old, inadequate pumping plant was replaced by modern centrifugal pumps without discontinuing service

By F. E. PETERSON
Commissioner of Public Works, De Kalb, Ill.



DeKalb's new tank; old tank in background.

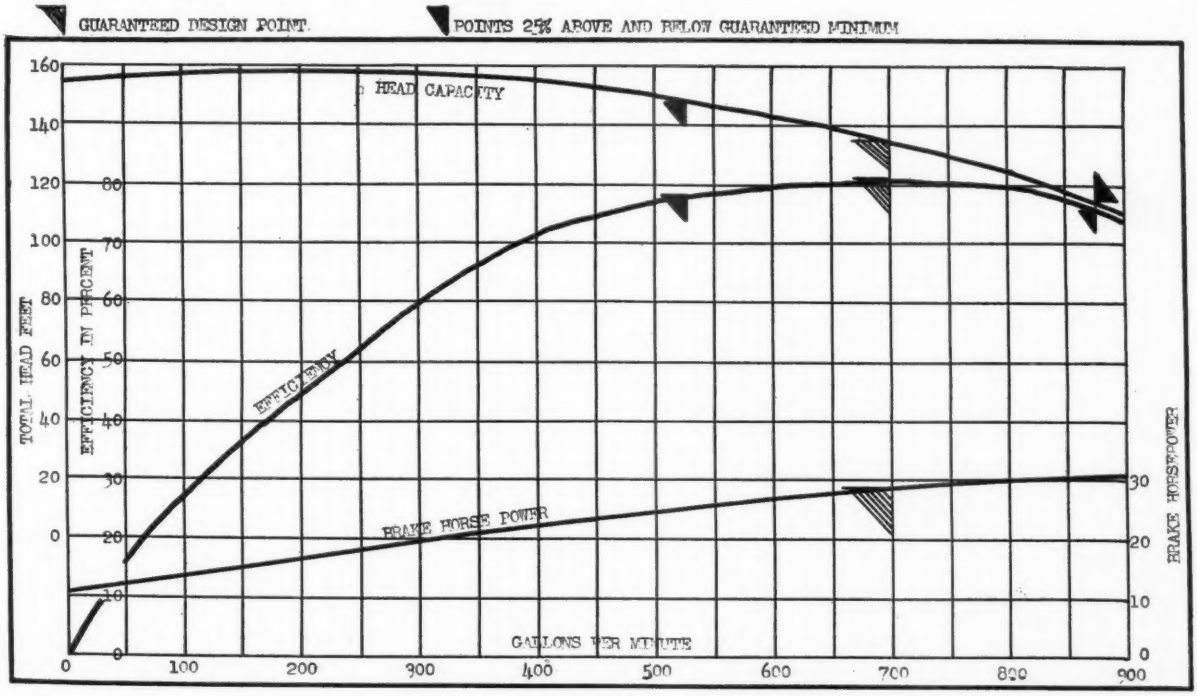
DE KALB, located in the center of a prosperous agricultural section of Illinois, contains several industrial plants and a State Teachers College. The population by the 1940 census (unofficial) is 9,155; but approximately 11,000, including the subdivisions adjoining the city, are more or less directly affected by the city's industrial, commercial and economic conditions.

Wells

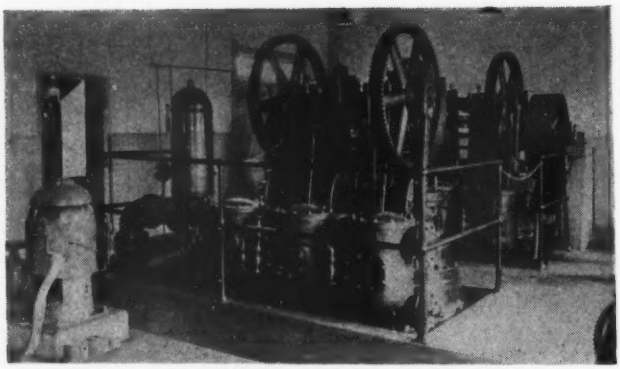
De Kalb's public water supply was installed in 1875 with the sinking of a 1,200 ft. and a 2,400 ft. well in the south side of the city, and a pumping station and wooden water tank. The last was replaced by a steel standpipe about 1890, and the two wells were abandoned about 1895 and replaced by a well in the western part of the city. At present the city is supplied from four wells.

Well No. 1 was drilled to a depth of 841 ft. in 1898 and deepened to 1,331 ft. in 1903. In 1936 the size was increased by reaming; from the 200 ft. to the 618 ft. depth the increase was from 9″ diameter to 15″ (the top 200 ft. was already 15″); from the 618 ft. to the 911 ft. depth from 7″ to 12″ diameter, and from there to the bottom from 6″ to 10″; the bore being relined at two points near mid-depth. To increase the capacity, the well was "shot" at three places —a 100 lb. shot at 725 ft., a 150 lb. shot at 1,250 ft. and a 150 lb. shot at 1,300 ft., solidified nitroglycerin being used. The enlarging and shooting increased the capacity from 200 gpm to 1,000 gpm with a drawdown of 35 ft.; a specific capacity which is still maintained.

Well No. 2 was drilled to a depth of 1,306 ft. in 1912; No. 3 to a depth of 890 ft. in 1895; No. 4 to a depth of 1,320 ft. in 1926. No. 2 was quite crooked, because of which the plunger pump had to be removed frequently for repairs. To ascertain the alignment, a ring slightly smaller than the well was suspended directly above the top of it, then lowered into it and, at ten-foot intervals, the direction and amount of deflection from the vertical of the cord supporting the ring was ascertained. These gave deflections as high as 4-5/16″S.E. from vertical at 110″, shifting to 7/8″ N.E. at 180 ft., to 2″ to the S.W. at 220 ft. However, the absolute accuracy of this information can be questioned.

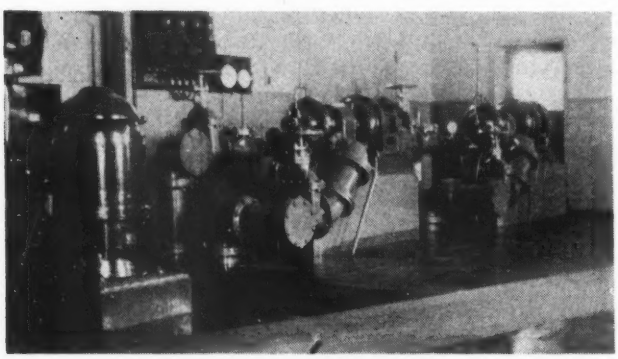


Characteristic curves of DeKalb's new centrifugal pump.



Old pumping plant—two 10 x 12 triplex pumps.

The centrifugal replacing one old pump while the other maintains service.



Both new centrifugals installed.

Well No. 4 dropped in capacity from 700 gpm to 400 gpm twelve years after completion, even with the water drawn down close to the pump bowls. It was cleaned, recased at one point, and shot in five places, using three 100 lb. shots at each of three levels and two 150 lbs. shots at each of two others. This restored the capacity to 700 gpm, increasing the specific capacity from 3 gal. to 12 gal. per foot drawdown.

Pump Installations

The first pump, in 1875, was operated by a single-cylinder steam engine; replaced later by a Dean pump with a 12″ diameter cylinder 3 ft. long. As stated, this well was abandoned about 1895.

Wells No. 1 and No. 2 were equipped with Keystone Driller Co. double-stroke deep-well plunger pumps, 10½″ cylinder, 18″ stroke. No. 3 contained air lift equipment, consisting of an Ingersoll-Rand 14¼″ x 12″ air compressor with 55 hp. motor. Well No. 4 was equipped with a deep-well turbine and discharges directly into the distribution system. Nos. 1, 2 and 3 discharge into a reservoir, from which two motor-driven Goulds 10 x 12 triplex pumps pump to the mains. A Lee 3-stage motor-driven centrifugal pump of 1,500 gpm capacity was (and still is) used as a fire pump.

The amount of water pumped increased from 165 million gallons in 1920 to more than 300 million in 1940; the revenue increasing at the same time from $25,000 to $50,000. Commercial and industrial consumption accounts for 30% of the total. Twenty percent is consumed by the State Teachers College, the largest single consumer.

In 1931 the plunger pump in Well No. 2 was replaced with a deep-well turbine, increasing the capacity from 300 gpm to 500 gpm. As stated above, this well was quite crooked, and several months after the new pump was installed, vibration in the drop pipe was observer, apparently caused by the casing pushing it slightly out of line at two points. Joint lugs at these points were eliminated by substituting longer sections of drop pipe, and the vibration ceased.

By the summer of 1935 the pumping demand required the operation of pumps 1, 2 and 4 for 24 hrs. a day. No. 3, the air-lift, had been kept as a stand-by, but it seemed necessary to bring it into regular service during the summer peak. However, its operation was uncertain and costly, and a second-hand deep-well turbine pump was rented for the rest of the summer at $75 a month, with the privilege of applying this to the purchase price of $1,200 if we decided to keep it; which we did after six months' use. This pump has a capacity of 250 gpm against a total discharge head of 350 ft., operated by a 25 hp. motor. This is still used as a standby.

The two Goulds triplex pumps previously referred to were replaced in 1939 with two American-Marsh horizontal centrifugal pumps, without discontinuing pumping service. Plans were made so that the piping below floor level did not have to be changed. We first removed the triplex pump shown in the foreground of Fig. 1, the other triplex being continued in operation. One of the centrifugals was then connected up where the old triplex had been, and when this was in operation the other centrifugal was substituted for the other triplex. The piping, four valves salvaged from the first installation, two check valves, and other fittings were installed by a local plumber assisted by our superintendent and workers at the water plant; who also assisted the electrician install the electrical units and wiring. All dimension drawings and piping diagrams were made in the office of the writer.

As the suction lift may become as great as 15 ft., two priming pumps were installed, one as an auxiliary, with tank, piping muffler and switches. The total pumping head is 125 ft., but we expect to install, in a very few years, an elevated tank with a water level 10 to 15 ft. higher than that of the present standpipe. Accordingly we obtained pumps with a flat efficiency curve, designed for 700 gpm and 1,050 gpm, respectively, against 135 ft. head; the discharges at the present 125 ft. head being 800 and 1,200 gpm, and the efficiency will remain practically the same up to 140 ft.

The cost of removing the triplex pumps was $61.80. Part of the old units was sold as junk (1,024 lb. lead cable, 69 lb. copper, 650 lb. of brass, 14.475 tons of cast iron and 2 tons of steel) for $236.33. The cost of the new equipment was: Two American-Marsh pumps, $464 and $619, respectively. Two priming pumps with accessories, $650. Piping, fittings and check valves for pumps, $481.39. Gauges, magnetic starters, switches, transformer and other fittings, $1,237.65; concrete foundations, $20.08. Total materials, $3,472.12. Labor costs were: Plumber, $66.63; welding, $13.16; electrician, $478.14; city labor, $257.20.

Rear view of a Barber Green spreader laying sand-asphalt surface on a Mississippi highway. (Line in center of pavement is due to spillage from screeds and will be covered by the center line stripes.)

Essentials to Rapid Construction of Better Bituminous Roads

Bituminous highway design provides excellent surfaces, but lack of standardization of specifications, and frequent changes in construction methods and procedures, reduce applicability of machinery to rapid construction.

DURING the past decade there has been a remarkable development in bituminous roads, so that today a surface can be designed that, while utilizing local materials to the maximum extent, is adapted to carrying any traffic load anticipated for the near future, and also can be economically improved to carry much heavier loads should the necessity arise. This progress has been accomplished through the joint efforts of engineers, manufacturers and material producers. Important factors have been the recognition of the necessity for proper preparation of the subbase by adequate drainage, utilizing the newer knowledge regarding soils; and development of methods for producing a properly mixed and entirely uniform surfacing.

The next necessary step appears to be a solution of the problem of standardization of the various procedures. So great has been the interest in low-cost road construction that contributions to progress have been made from all parts of the country. These, naturally, have reflected the ideas of the individuals proposing them, and varied with the local materials available and the needs of the particular state, county or city where they originated. Standardization is necessary (1) to permit the development of sound and widely applicable specifications; (2) to simplify the procedures in construction and inspection; (3) to require the use of adequate and proper equipment; and (4) to encourage the development of equipment adequate to produce these better surfaces at higher speeds and lower costs. Such equipment, obviously most desirable, cannot be developed under dissimilar and constantly shifting specifications.

Such standardization should not produce rigid and inflexible specifications, nor should it be of such nature as to prevent the development and testing of new ideas and new methods. Because the best design will fail unless it is properly constructed, and because equipment will surely be used in increasing amount in coming years in such construction, specifications must be drawn up with the equipment factor in mind. One method for effecting this is to provide specifications based on the requirement of results rather than on the following of detail procedures. This idea is not new and its use has often resulted in excellent work. Under these requirements, the application of equipment on hand, or of new equipment, to obtain the required results places an added responsibility on the constructor, whether he be contractor or engineer.

A thorough study of the possibility of the use of such specifications should be made. The adoption of workable result requirements would have many advantages, including the education of the road-building industry in the necessity of the use of good equipment, as well as of good materials, in order to produce a good job; not only the better utilization of the tremendous amount of road-building equipment now owned by cities, counties and states, but also the encouragement of these governmental units to replace old equipment with newer and more efficient types; and last, but not least, the incentive it would offer to the manufacturers to produce more efficient, economical and speedy equipment for the work.

It is doubtful if the value of modern equipment is fully realized by most governmental officials respon-

(Continued on page 36)

Modern Equipment Completes Runways in Record Time

CONSTRUCTION of airports in Canada is being pushed, in line with the great effort in aviation that the Dominion is making. Modern equipment is being used to speed construction. The work done at the Calgary, Alberta, airport is typical. The contractor is the R. G. Taylor Construction Co., which is constructing a series of airports for the Dominion government.

Grading and leveling work was expedited by the use of three LeTourneau Carryalls hauled by Caterpillar RD 8 diesel tractors. A No. 11 Caterpillar Auto Patrol grader was used for finishing. The grading and finishing were so accurately done that the runways were within ⅜-inch of being level across the 150-ft. width.

There are seven runways, each 3,800 ft. long. The subbase and base courses are of 1-inch broken stone, with a small percentage of fines. The subbase course, 3 inches thick, was first placed, sprayed with water and rolled. On top of this was placed another layer of 1-inch material and fines, also 3 inches deep; 25 pounds of salt, dissolved in water, was applied per cubic yard of material in this course.

After drying, 0.25 Imperial gallon of MC-1 asphalt was applied per square yard, and allowed to penetrate and cure for about 36 hours. Then 0.25 Imperial gallon of RC-4 asphalt per sq. yd. was applied, and the first coating of chips placed. This coating consisted of 20 lbs. per sq. yard of ½-inch and smaller, and was applied by means of a Universal Spreaderoller, which spreads the chips and rolls them into the bitumen in a single operation.

Following the placing and rolling of the first coating of stone, 0.20 Imperial gallon of RC-4 asphalt was applied and the final layer of aggregate spread and rolled. This layer, consisting of 20 lbs. per sq. yd. ¼-inch and smaller, was also placed and rolled with the spreaderoller.

On one section of the Calgary job, a time and material study was made of the performance of the spreaderoller. In 120 minutes of operation, 50 minutes were spent in actual spreading and rolling operations; the other 70 minutes being consumed in turning at the ends of the runway and in loading. Loading requires that trucks back up the ramp, dump, and drive off the ramp. The capacity of the hopper is 4 cubic yards; there are three rollers, each 30 inches in diameter. Width of spread is 10 ft., but can be adjusted for narrower spreading.

Spreading chips and rolling them in a single operation.

In the 50 minutes of actual operating time, 47,500 sq. ft. or 5,280 sq. yds. were seal coated, ready for immediate use. The aggregate material used on this section for seal final coating amounted to 113,800 pounds, which shows that the average cover was 21½ lbs. per sq. yard. Actual spreading speed was 1.08 miles per hour, based on the working time. Even including loading and turning time, rate of placement of final seal coat was 2,640 sq. yds. per hour.

Photographing An Entire State

The entire State of Pennsylvania covering 45,126 miles has now been mapped by air-photography, 40,000 separate photographs having been made. It still remains to fit these separate photographs into mosaics, but when this has been done these maps will be of sufficient accuracy for use in local regional or State planning; for industrial planning; for State forest or State game land management and for highway reconnaissance surveys. A higher degree of accuracy, suitable for detailed highway surveys or for general military use, can be obtained at a cost of approximately $130,000; but for the purposes first named, the cost would approximate only $85,000. The cost of the surveying itself was about $450,000, of which the Agricultural Adjustment Administration of the U. S. Department of Agriculture contributed about $300,000.

These seem like large sums, but to obtain the information in any other way would have cost many times as much. In addition, this information, which was obtained in a few months by air-photography, would have taken many years by ground surveying methods, and information obtained during the earlier years might be entirely out of date before the survey is completed. Moreover, the information obtained by air-photography is much more complete than is ordinarily obtained by ground surveying. These maps show every sizeable tree, every house and garage in the entire State, every highway and by-way. Surveys of six Connecticut towns revealed 1,237 residences, 12,534 garages and barns and 13,866 lots which had escaped taxation. A study of the maps of Pennsylvania has shown beginnings of erosion that might become serious, road layouts causing traffic hazards or unnecessary delays, bad urban developments and many other features which only such large-scale pictures point out so prominently.

These photographs can be consulted at any time at the offices of the planning board, and air-photographs and enlargements for complete counties can be obtained at any scale desired. Taking Mercer Co., Pa., as an illustration, the board states that maps giving a complete coverage of the county can be obtained for $37 or slightly more than 5c a square mile. Enlargements to a scale of 600 ft. to the inch can be obtained for $160 or approximately 23c per square mile. For quantities the prices would be considerably less. For contact prints 7 x 9″ or 9 x 9″, the price is 50c each for five or less but only 20c each for over 100. If prints are made on water-proof paper the price is 10c per print additional. For enlargements of different sizes up to 27″ x 28″ made from a single negative, the price is $1.25 each for five or less and 75c a piece for over 100.

Waterworks Men, Toronto Awaits You!

Host to 61st Annual Convention American Water Works Association, Royal York Hotel, June 22-26

"Go abroad" at home! Visit war-bound Canada and the A.W.W.A. convention sessions at the same time. Learn at first-hand how our great northern neighbor carries on; maintaining water supply facilities at peak efficiency under industrial and military emergency conditions.

Manufacturers exhibits will be a whole exposition of what is newest and best in waterworks equipment and materials—an education in themselves. See what progress has been made since Kansas City in 1940.

A.W.W.A. President Norman J. Howard, Director of Water Purification of Toronto, as one of the committee of eleven under the chairmanship of William J. Orchard, is arranging the technical sessions and entertainment program to give you something long to be remembered.

Every modern-day waterworks problem will be under discussion. Every day will be filled with contacts with interesting people and ideas. Plan NOW to attend. For any further details, write to Joseph M. Wafer, 230 Park Avenue, New York, N. Y., for special bulletin.

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Setting Corrugated Culverts in Soft Ground

Editor, PUBLIC WORKS.—On page 14 of the August issue of PUBLIC WORKS is an article on the installation of flexible pipe that has attracted considerable attention, especially the statement about the importance of horizontal struts. I would like to make the following comments on the two problems presented.

In the case of the 135" sectional plate pipe, the foundation should be stabilized as you recommended, preferably for ½ diameter beyond the horizontal projection of the pipe to form a foundation for the columns of earth alongside the pipe. The gage of the pipe is a function of the diameter, cover, live load and whether strutted or not. Unfortunately, the inquiry stated the diameter accurately and the rest had to be assumed. If the pipe was not to be strutted (installed without elongating the vertical diameter), I think your gage recommendation was sound. Were the pipe to be strutted, the gage could have been reduced on the top and sides. The invert plates might well be heavier to give a more balanced design, as the invert plates naturally receive more wear than the side or top plates.

In the case of the 72" twin installation, they should have been spaced so that their centers were at least 1½ diameters apart. This practice gives ½ diameter between pipes which is necessary in order to do a thorough job of tamping under the haunches between the pipes. The amount of elongation of the vertical diameter was slightly more than the customary 5%. This over-elongation naturally weakens the pipe against lateral forces just as it strengthens it against vertical forces. With a gage too light to begin with, weakened by over-elongation, the excessive tamping kept shortening the horizontal diameter until there was insufficient resistance to withstand the normal lateral earth pressure, the final result being a "negative" failure.

The purpose of strutting (always vertical) is to increase and hold the vertical projection in order to develop more side support so that when the installation is complete and the struts are removed the pipe is round or with a slightly elongated vertical diameter. Horizontal strutting is not recommended (or used to our knowledge) because with pipe of the proper gage and not over-elongated it is almost impossible to overtamp.

ARMCO DRAINAGE PRODUCTS ASSN.
G. E. SHAFER, *Chief Engineer.*

What Is a 100-Mesh Sieve?

Editor, PUBLIC WORKS.—When a "100-mesh screen" is specified, should this be interpreted as being 100 openings per lineal inch, regardless of the size of the wires, or should each opening be 1/100 inch across? City Engineer.

Reply by P. J. Smith, American Society for testing materials: I believe that you will find of interest the standard Specifications for Sieves for Testing Purposes (E 11 - 39) that have been issued by the Society, a copy of which I am accordingly enclosing. The preferred method of designating sieves today is by use of the micron or U. S. standard sieve series number rather than specifying the "mesh" of the sieve. A description of the procedure for determing "mesh" of a sieve is given in the Appendix of specifications E 11.

Further data were forwarded by L. V. Judson, Secretary of Technical Committee III on Particle Size and Shape, Committee E-1, as follows: I am in agreement with everything Mr. Smith stated. I wish, however, to emphasize that 100 mesh sieve cloth is never to be interpreted as cloth with openings 1/100 of an inch across. It is to be regretted that sieves were ever designated by the term "mesh" because the openings of two sieves having the same mesh but different wire diameters will not be the same. Many years ago such differences were not considered important, but they are important now. Every effort should be made to discourage the use of the term "mesh" as a designation for sieves or sieve cloth. The arbitrary number system which had the advantage that it conveyed a general meaning to persons with long previous experience with sieves, or the more scientific micron designation should be adopted by all users of sieves.

Operating Revenue for Municipal Airports

Of the 650 municipal airports in the country, only about 10% have incomes that meet their operating expenses, the remaining 90% drawing on tax funds for operating deficits. Cities are therefore naturally looking now for means of meeting these charges.

At the approximately 200 terminal airports, about 86% of the revenue comes from landing fees, hangar and storage fees, rents, and income from oil and gasoline sales. There is little uniformity in the schedule of charges. In a number of the airports the hangar and storage fees range from $1.00 to $2.00 a night and from $5.00 to $50.00 a month. Annual income from ground rental and office space ranges from $8,500 in one city to nothing in others. Landing fees range from $125.00 a month to nothing. A few cities have developed other sources of revenue. Minneapolis reports a net income of $4,000 last year from a city-operated refectory and further income from hotel and garage at the air field. Madison, Wis., leased unused area of the airport for farming at $500 a year, while Little Rock, Ark., last year obtained $1,000 from hay harvested from its air field.

Other sources of revenue suggested are taxes on aviation-used gasoline (which is now exempt in 28 states); use of the field for test flights by aircraft manufacturing plants; and charge of rental for space used by the Weather Bureau and Post Office Departments, which is already practiced by a few states.

The largest item in the operating expenditures at the 200 terminal airports is that of salaries, which average 53%, the other 47% going for light, heat, power, hangar operation, insurance and other expenses.

Raw Sewage Strengths Studied by Texas Department of Health

In an effort to assist cities in planning adequate sewage treatment plants, the Texas State Department of Health conducted a study of raw sewage strengths in some 83 Texas cities. The average strength of the sewage in the cities studied was as follows:

B. O. D.	356.0	p.p.m.
Suspended Solids	362.78	p.p.m.
Oxygen Consumed	132.36	p.p.m.
Ammonia Nitrogen	37.94	p.p.m.

An interesting item that the study disclosed was that the B. O. D. varied from 87 p.p.m. in one city to 1240 p.p.m. in another.

ID-6 For real Diesel economy and performance, choose the International ID-6, shown here with road grader.

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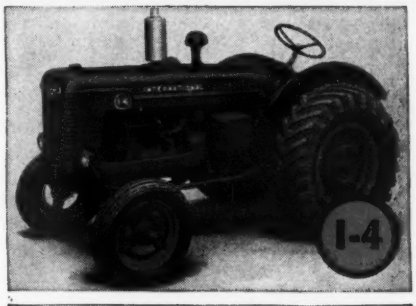

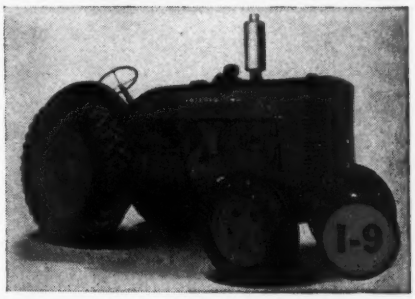

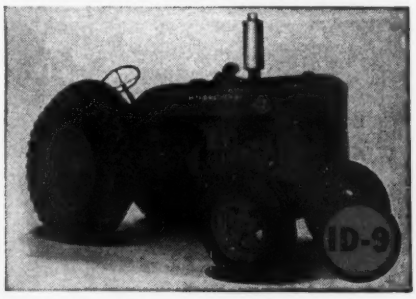

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Three of these new "I" models have carburetor-type engines—two have quick, easy-starting, *full* Diesel engines. They are streamlined, efficient, economical—ready to cut costs to the bone on a wide variety of jobs

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All of these tractors have Tocco-hardened crankshafts, pressure lubrication, replaceable cylinders, five forward speeds up to 15 m.p.h., gear drive, countershaft brakes that can be individually controlled or interlocked, provision for mounting a variety of allied equipment, and many other features.

See these tractors at first hand. Ask the nearest International Industrial Power dealer or Company-owned branch for full details.

INTERNATIONAL HARVESTER COMPANY
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Equipment the "I" Tractors Will Handle in the Construction Field:

Maintainers and graders; front-end shovels and loaders; cross-walk, side-walk, and other types of snow plows; road rollers; cranes and hoists; winches; brushes and sweepers; disk harrows and mixers for mixed-in-place roads; scrapers; dump wagons; trailers; tampers; mowers; etc.

"I" Tractor Facts

I-4—4-cylinder valve-in-head gasoline engine. Bore and stroke 3⅜ x 4¼ in. 5 forward speeds up to 15 m.p.h. Develops 29.5 engine h.p. at 1,650 r.p.m.

I-6—4-cylinder, valve-in-head gasoline engine. Bore and stroke 3⅞ x 5¼ in. 5 forward speeds up to 14 m.p.h. Develops 40.5 engine h.p. at 1,450 r.p.m.

ID-6 DIESEL—Quick-starting, 4-cylinder, compression-ignition, 4-cycle Diesel engine. Bore and stroke 3⅞ x 5¼ in. 5 forward speeds up to 14 m.p.h. Develops 38.5 engine h.p. at 1,450 r.p.m.

I-9—4-cylinder, valve-in-head gasoline engine. Bore and stroke 4.4 x 5.5 in. 5 forward speeds up to 15 m.p.h. Develops 54 engine h.p. at 1,500 r.p.m.

ID-9 DIESEL—Quick-starting, 4-cylinder, compression-ignition, 4-cycle Diesel engine. Bore and stroke 4.4 x 5.5 in. 5 forward speeds up to 15 m.p.h. Develops 51.5 engine h.p. at 1,500 r.p.m.

...and in the New INTERNATIONAL-A HIGHWAY MOWER

• THIS NEW side-mounted mower cuts a 5-ft. swath at mowing speeds up to 6 m.p.h. Cuts at any angle from 90° above horizontal to 45° below horizontal. Enclosed, heat-treated gears run in oil bath.

NTERNATIONAL Industrial Power

Sewer Maintenance in California

THE Sewer Maintenance Division of the City of Los Angeles, Calif., has charge of a sewer and storm drain system containing 2,794 miles of sewers and 630 miles of storm sewers, there being 11,599 flushing structures connected with the former and 26,200 catch basins with the latter. For the purpose of maintenance the city is divided into approximately 350 sewer districts, each with its own map showing the location, street and other details of each sewer. The entire system is inspected during each six-month period and necessary repairs or changes made.

For actual maintenance work there are 29 field crews, each consisting of a foreman and 2 or 3 men and a truck. The trucks are of 1½-ton canopy type and carry a full complement of tools for maintenance work, such as 350′ of all types of sewer rods, 500′ of 2½″ fire hose, hooks, cutters, spears, scoops, augers, self-propelling nozzles, picks, shovels, bars, gads, buckets, lanterns, flash lights, mirrors, spot-lights with 50′ of cord, safety belts, rope, hydrant wrenches, hammers, sledges, beach-balls and rubber hip boots for each member of the crew. There is also a trailer hook for hauling pumps, and five dump trailers are used for catch basin cleaning. Some of the trucks are equipped with 120-volt electric generators which are used to operate an electric driven fan for ventilating manholes and pipe lines that contain dangerous gases. The generators also operate an electric drill, hammer or saw and will operate 15 or 20 electric lights for night work or work inside sewers.

Reliance is placed chiefly on flushing for keeping the sewers clean. There are six types of automatic flushers on the sewer system as well as hand-operated flushing manholes. Six field crews with two men each with trucks and a shop crew maintain all the flushing structures. Automatic flushers are installed on flat grades and hand flushing is used where the grade is 1.6% or more. The automatic flushers operate daily, discharging 300 gallons of water every 24 hours, while the hand-operated flushers are flushed every four to six months using 500 gallons per flush.

Occasionally stoppages occur, in spite of flushing, caused by sand, rags, hot grease or other insoluble materials, and these are removed by using rods of iron or wood, flexible steel rods, etc. To produce scouring of deposits, use is made of beach-balls, or rubber cups attached to rods which operate in much the same way, the general idea being that the sewage passes with high velocity between the outside of the ball or cup and the sewer and thus scours out the deposit.

All large storm sewers are inspected twice a year, before and after the winter rainy season. In 1930 there

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were 95 sewer stoppages, 13,435 manholes cleaned, 204 miles of sewer cleaned and 126 miles of sewer flushed. On the storm sewer system, 56,479 catch basins were cleaned, 158 miles of storm sewer cleaned and 137 miles inspected.

Constant complaints are received about noisy manhole covers and the use of hot tar seems to be the most satisfactory remedy, although it has been renewed from time to time. Of the 70,000 manhole covers in the city, 2,815 noisy ones were attended to in 1938 and 1,833 in 1939 at an average cost of $1.58 each.

The maintenance division has a gas survey crew of two men and a truck which systematically tests manholes with a view to preventing gas explosions and eliminating dangerous locations. A card index is kept of all dangerous locations, the date tested and when rechecked. When very dangerous conditions are found, the sewer district foreman and superintendent and the utility company are notified immediately. In addition to these inspections, effort is made to secure the proper disposal of inflammable liquids by inspection of gas and oil filling stations, garages and repair shops; by investigating complaints of odors and by cooperation with the city and utility companies.

The Los Angeles County Sanitation District maintains 200 miles of trunk line sewers from 8″ to 126″ diameter, tributary to which are over 500 miles of sewers maintained by the county and 750 miles of sewers in 23 incorporated cities. Every mile of the county sewers is thoroughly cleaned at least once a year and some oftener, using crews of three men and a Ford truck. Sewers up to 24″ diameter are cleaned by passing through them a heavy rubber ball onto which has been sewed two or three layers of burlap to which a rope bridle is attached, the rope retarding progress of the ball through the sewer sufficiently to give the desired jetting action. As the ball nears each manhole, it is stopped temporarily with a wooden disk and a prop while the debris is shoveled into a bucket and removed. In pipe between 27″ and 48″ diameter, a wooden disk is used slightly smaller than the pipe and held upright by a 4 x 4 wooden tongue extending aft, strap irons being bolted to its end to maintain it horizontally; pieces of tire casings being nailed to the rim of the disk. In still larger sewers a hoe type of wooden drag with a tongue floating astern has been used with success; several hundred pounds of concrete blocks often being attached to the blade to prevent its sliding over bottom deposits.

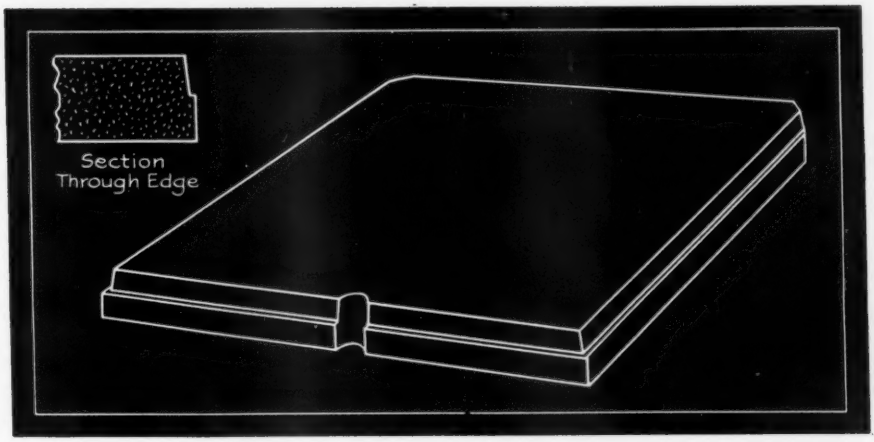
Occasionally the maintenance crew must measure the volume of sewage flowing and has developed for the purpose a Venturi flume, three-piece portable sheet and cast iron flumes being used extensively.

The above is abstracted from papers before the twelfth annual conference of the California Sewage Works Association, by R. F. Brown, Ass't Sup't of Sewer Maintenance, of Los Angeles, and Fred D. Bowlus, Resident Engineer, Los Angeles County Sanitation Districts.

Sterilizing Jute for Water Pipe Joints

It is now generally believed that, in some cases at least, jute used in calking joints of bell-and-spigot pipe contains bacteria, some of which may be coliform; and that chlorine used for sterilizing new mains does not have much effect on the jute in their joints. The only effective solution of the problem seems to be to

The Latest In Rapid Sand Filter Construction



Detail of Norton Porous Plate used in filter bottom showing rabbetted edge for suitable seal and cut-outs for three-point stud support.

IN DESIGNING a new or redesigning an old rapid sand filter, consideration should be given to the patented Camp construction, using Norton Porous Plates as a false bottom.

This design provides equal rates of flow of wash water through every square inch of bottom, insuring long life and efficient filter operation.

Norton Porous Plates have built into them exactly the qualities necessary for operation in installations of this character — qualities determined after careful study and experimentation and proved in service.

If you have in mind rapid sand filter construction or reconstruction, don't fail to get information on these plates.

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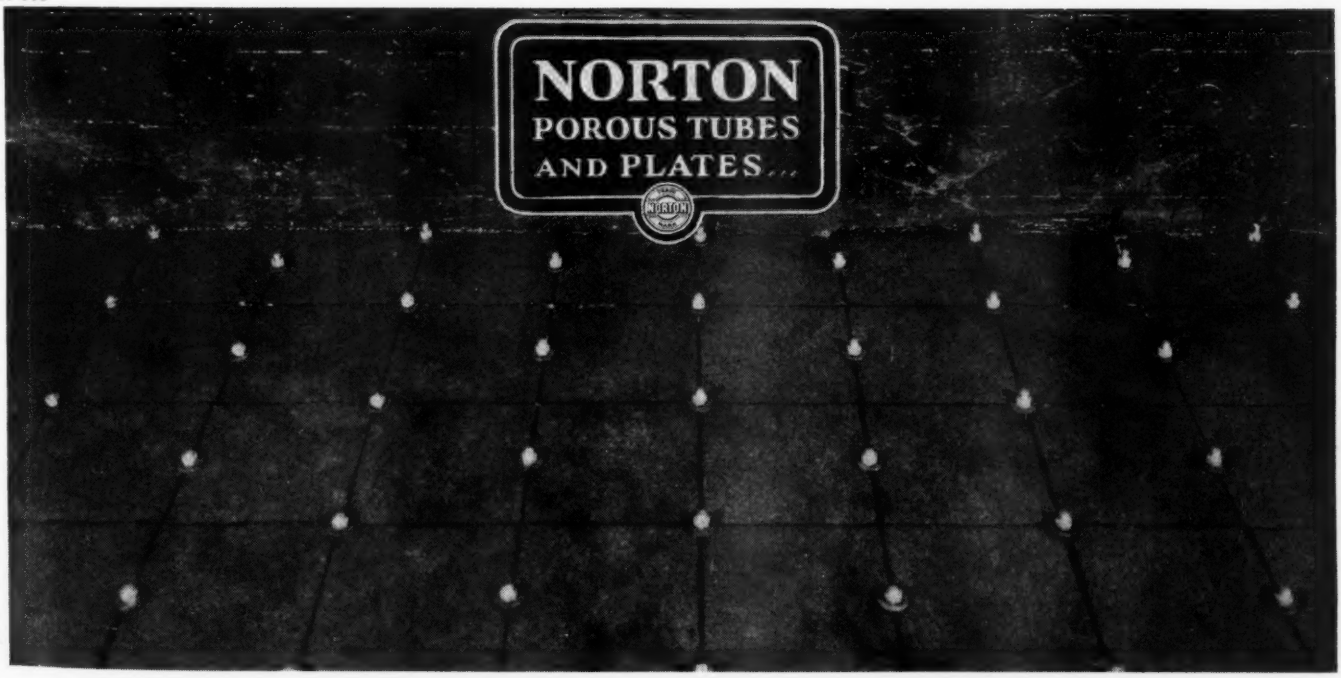

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use only sterile jute or other sterile material in the joints.

Replying to a recent questionnaire, 18% of about 500 water superintendents reported using sterilized jute. Of these, 6½% purchased packing already sterilized by the manufacturer; the others treated the jute themselves. H.T.H. or Perchloron was used by 50% of the cities for sterilizing the jute; 30% soaked it in a solution of hypochlorite or a "chlorine solution." One used powdered quicklime. Seven steam the jute and two sterilize it by heat.

Among the details mentioned are: "Dry rope jute is soaked in a chlorine solution and again dried before using." (Glassboro, N. J.) "H.T.H. in capsules is placed in the jute." (Canton, Ill.)

Loss of Water Main Capacity Through Deposits

A 6-INCH pipe which has accumulated a lining of tubercles averaging a half-inch thick is no better than a clean 4-inch one—gives no more effective fire protection nor any better pressure under maximum flow. To a less extent (in that the deposits have a smoother surface and create less friction loss) deposits of mud or other suspended matters and rust also reduce pipe capacity. In bygone days deposits of earthy materials in mains were common, but with present high standards of clarification they are much less so. However, with even a minute amount of suspended matter a part of it is apt to be deposited, especially in dead ends. Also, deposits are caused in some cases by chemical action whereby matters in solution in the water in the mains become insoluble; also by biological growths in the mains. Some deposits due to chemical action form an incrustation on the entire surface of the pipe and are difficult to remove, but the sediments are commonly removed readily by flushing if not allowed to remain too long.

In most systems there is more or less depositing of suspended matter—probably very few do not contain at least a few hydrants which discharge colored water for a minute or two when opened full flow. It is worthwhile for every water superintendent to find out how many mains in his system contain incrustations in order that he may take measures to remove them and so restore the capacity of his system and to prevent recurrence of them.

In a questionnaire sent by us to waterworks officials we asked whether the capacity of their mains was reduced by deposits, and 429—about three-fourths of the questionnaires returned to date—answered this question. (Presumably most of the others were not certain of the answer.) Of these, 59% reported no deduction in main capacity from this cause; 21% said that there was "some reduction," "slight," etc., and 20% did not qualify their affirmative answer. Most attributed the reduction to "incrustration" although a few specified tubercles, rust, sand, etc.

The presence of deposits was learned in a number of ways. In 38 cities the inner surfaces of pipes were actually inspected, usually when repairing breaks or making extensions. In Kenosha, Wis., a 14″ main that had been in service for 40 years was taken up and examined. Such examination gives reliable and definite information as to both the amount and nature of the deposits.

Other cities obtain information less directly by making flow tests and comparing them with past or theoretical capacity; 27 reported this method. Twenty-one, finding a falling off in pressure in some or all parts of the system, attributed it to pipe deposits; and one considered increased pressure at the pumps due to this cause. Among other indications reported were dirty water when flushing, sand found in meters and services, rust flushed from fire hydrants, etc.

This matter of reduced capacity and pressure is a most important one. Means are available whereby tuberculation and deposits can be prevented from forming in mains and those already formed can be removed. These means we propose to describe in detail in a special article in our June issue.

Laying Inverted Emulsified Asphalt

By T. L. BALL, City Manager

Decatur, Texas

With the assistance of the WPA, the city of Decatur, Texas, last year laid about 30 blocks of inverted emulsified asphalt surfacing, using creek gravel for the coarse aggregate, and constructed sidewalks, curbs and gutters. To get the project started, the city purchased a cold-mix machine and a screen. Suitable material for both the paving mix and for the concrete for the curbs, gutters and walks was obtained from a nearby stream and screened to the desired size.

The first step was the construction of the curbs and gutters. The streets were then graded and the base material of shell, gravel and clay was placed and rolled so that the finished surface was 1½ ins. below the level of the gutter. A tack coat of asphalt was applied and left for 24 hours. The cold mix was then spread to such a depth that under rolling it compacted to 1½ ins., and rolled, after which the road was opened to traffic.

The cost of the work to the property owners was as follows: For paving, 40 to 50 cents per lineal foot for streets 30 to 36 ft. wide; for sidewalks, 15 cents per lineal foot; and for curbs 15 cents per lineal foot. Though 1940 was a very wet summer, the pavement has stood up most satisfactorily.

Automatic Control for Water Works

The use of automatc control in connection with water works operation is increasing in both large and small plants throughout the country and probably few new installations are being made that do not include it to a greater or less extent. This is especially true of filtration and softening plants.

The maintaining of water levels in tanks and reservoirs automatically is another common practice. Of several hundred cities replying to a questionnaire on this subject we find 42% supplied with such control. As a considerable number of the systems do not include tanks or standpipes, the percentage of those that do is probably considerably greater than this.

Automatic control of pumping is not quite so common, but about 32% of the cities report use of it. Several descriptions of such use have been published by us; and the various devices employed are described in some detail in our Manual of Water Works Equipment and Materials.

Essentials to Rapid Construction of Better Bituminous Roads

(Continued from page 25)

sible for local road building. Benefits may be derived in two ways: (1) Direct saving in construction costs; (2) the production of a better and more uniform quality of work. One county engineer, for example, reports a direct saving, on 30 miles of construction and maintenance, of $13,500 through use of a single piece of modern equipment, specifications and general construction procedure being the same. The production of better quality work is not always so easy to evaluate, but is well known to those familiar with the many important details in highway construction.

The necessity for uniformity of construction becomes most clearly apparent after a period of service. "Fat" or "lean" spots, where too much or too little bitumen has been applied, require early maintenance; pockets wholly or largely of coarse or of fine aggregate likewise require maintenance attention after brief service. It is in such factors as these that modern equipment pays for itself many times over. It is almost impossible to obtain as uniform distribution of aggregate or bitumen by hand as is readily obtainable by proper equipment, and the latter is cheaper for jobs of any size.

Through the past few years, there has been a decided trend toward the use of the denser mixtures with heavier bitumens. Proper handling of these heavier mixes requires either the use of the pug-mill type of mixer, in which a thorough and complete mixing is accomplished with measured amounts of aggregate and bitumens, or the use of modern powerful graders, coupled with careful control of the quantity and quality of materials. Traveling types of mixers are available, one advantage of which over road mixing is freedom from delays due to weather conditions, resulting in production of a greater area of finshed surface in a given period as well as more assured uniformity of mix.

Answer to "Timewaster"

Mr. Reginald H. Thayer writes us: "Your Timewaster for February, 1941, involves two unknown quantities, and the data furnished appear to be sufficient for writing only a single equation. If I am correct in this the problem is not susceptible of direct solution. Possibly it is not the most direct, but the following method may be used.

"Let X equal the number of cents indicated on the check and Y the number of dollars. Then the value of the check expressed in cents will be 100Y plus X cents, and the amount received from the bank will be 100X plus Y, also in cents. Then

100X plus Y equals 2(100Y plus X) plus 59.

Simplifying,

98X equals 199Y plus 59.

"It is evident that Y is an odd number. Trying various odd values for Y in this equation, we find that the conditions are met when Y equals 13, which makes X equal to 27.

"The check was for $13.27."

The determination may be facilitated by noting, from the equation 98X—199Y=59, that the product of 8 and X must end in a numeral 1 less than the product of 9 and Y; or, if X=1 then Y=1; if X=2 then Y=3, etc.; also that X must be slightly more than twice Y.

Treating Milk Wastes by Two-Stage Filtration

(Continued from page 20)

sloughing periods. The sand filters then showed a slight loss in nitrification, probably due to the extended periods of flooding caused by the sealing of the sand surface by sloughing solids.

Nitrites and Nitrates: Average of Composited Samples

	Nitrites	*Nitrates*
Filter "A" effluent	0.07 p.p.m.	0.22 p.p.m.
Filter "B" effluent	0.90 p.p.m.	8.03 p.p.m.
Final effluent	0.65 p.p.m.	7.21 p.p.m.

An increase or "pick up" of dissolved oxygen was obtained throughout the different stages of treatment. At times the dissolved oxygen content of the final effluent was as great or greater than the dissolved oxygen content of the receiving stream. Ordinarily no dissolved oxygen was found in the raw or settled sewage, but during some very heavy storm flows, slight amounts were present.

Under certain conditions it may be economical and feasible to convert contact beds to trickling filters, which effect more purification for the stone used than contact beds. Peak loads have been handled satisfactorily by two-stage filtration at Marysville, Ohio. On July 19, a removal of 47.7 pounds per 1,000 cubic feet or 2,084 pounds per acre foot on Filter "A," and on July 8, a removal of 10.9 pounds per 1,000 cubic foot, or 476 pounds per acre foot on Filter "B," was obtained. This type of filtration is feasible for reducing B.O.D. in exceptionally strong sewage to a figure suitable for application on sand filters. M. W. Tatlock's experimental filter data* showed that about 50 per cent of the B.O.D. reduction comes in the first foot of a trickling filter. Through the use of two-stage filtration at Marysville, the sewage is given two doses on the "essential B.O.D. removing" stone of the filter.

Two-stage filtration also provides greater nitrification with heavier loadings and removals than that on single stage filtration. The paper on "Trickling Filter Loadings" by G. Albro Hall and B. F. Hatch† indicates that generally when filter removals exceed 15 pounds B.O.D. per 1,000 cubic feet, the nitrification is negligible. Nitrification at Marysville was satisfactory, having an average of 8.9 p.p.m., NO_2+NO_3, in "B" filter effluent.

No positive statement can be made regarding the suspended solids and total solids determinations, since the entrained solids in the old contact beds were not entirely removed before these tests were started. The heavy industrial load at the Marysville plant is from June through September. Ordinarily most filters would have been in the best condition at that time to treat such loads, but due to the enormous load of solids stored in the filter medium, this was not the case, and

	pH Limits.	*M.O. Alkalinity Limits As $CaCO_3$*	*Average Dissolved Oxygen Content*
Raw	6.8 to 7.4	117 to 376 p.p.m.	...
Settled effluent	6.8 to 7.7	135 to 496 p.p.m.	0.15 p.p.m.
Filter "A" effluent	6.9 to 7.5	154 to 450 p.p.m.	2.04 p.p.m.
Filter "B" effluent	7.0 to 7.6	114 to 300 p.p.m.	2.90 p.p.m.
Final effluent	7.1 to 7.4	138 to 319 p.p.m.	4.30 p.p.m.

it is anticipated that better removals will be effected after the filters have been cleansed of old deposits.

Flexibility in the operation of the filters also is important, there being an added cost for the double pumping required. Single-stage filtration is used during the season of normal flows and two-stage filtration during the season of strong flows.

*Tenth Annual Report Ohio Conference on Sewage Treatment, page 33.
†Tenth Annual Report, Ohio Conference on Sewage Treatment, page 18.

Acquiring Marginal Lands For Highways

INCREASING interest has been directed in recent years to the problem of providing adequate rights-of-way for streets and highways. The construction of express highways and freeways to serve expeditiously large volumes of motor-vehicle traffic has become a serious problem in many of the more densely populated areas of the United States. The widening of existing routes as well as the adequate development of new routes is frequently delayed by the excessive costs of land acquisition, particularly in highly developed areas.

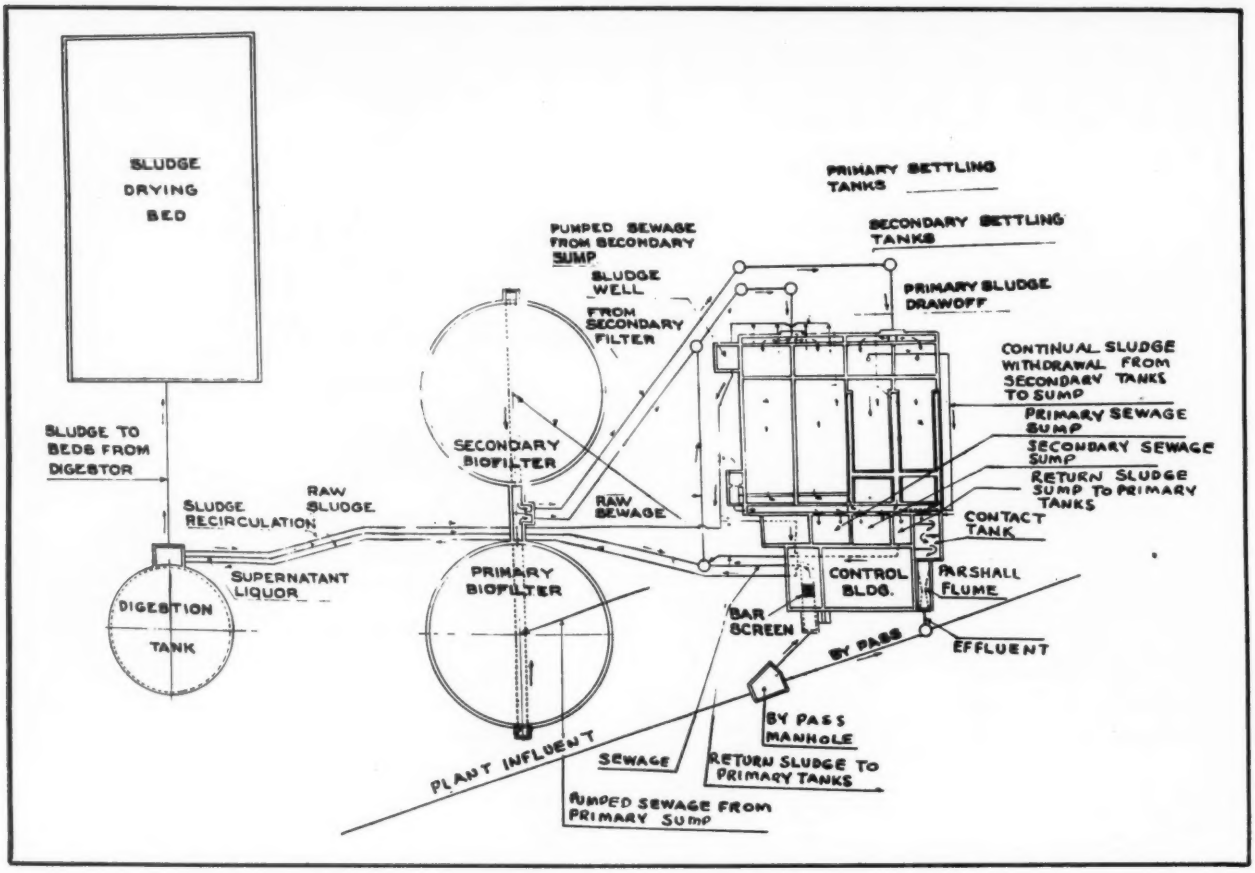
An important part of the right-of-way problem is the acquisition or control of land outside the immediate boundaries of a given improvement. Such acquisition is generally desirable from the standpoints of appearance, safety, economy, and the general public welfare. The taking of additional land may also facilitate the future development of a highway, particularly where widening may become necessary because of increased traffic. It has also been suggested that since increased property values often accompany a public improvement, measures should be taken to conserve this unearned increment to the public so as to defray in part the cost of the improvement. The conservation of these increased values may be accomplished through acquisition of excess land at the time of the improvement with subsequent resale after its completion. The acquisition of these excess lands either for marginal control or recoupment is commonly referred to as "excess condemnation."

But public improvements do not always increase the values of adjacent properties. Normally there may be an increment of value in connection with a highway development, but the relative amount of this increment will, to some extent, vary inversely with the length of the improvement. That is, as the length of the development increases the percentage of value increment decreases.

A major highway development may open more territory than can be absorbed immediately and lead to premature and uneconomic subdivision. Although an increment of value may result from a public improvement, and although the public can conserve this increment for itself either through the acquisition of excess land, the operation of a public land fund, or the imposition of special assessments, it can do so only after careful planning and investigation.

A consistent policy of marginal land acquisition may be effective: (1) In solving the economic and general community problem of handling land remnants created as a result of street or highway improvement; (2) in eliminating or reducing consequential

(Continued on page 53)



Layout for a bio-filter plant, Link-Belt Co.

Sewage Treatment for Airports

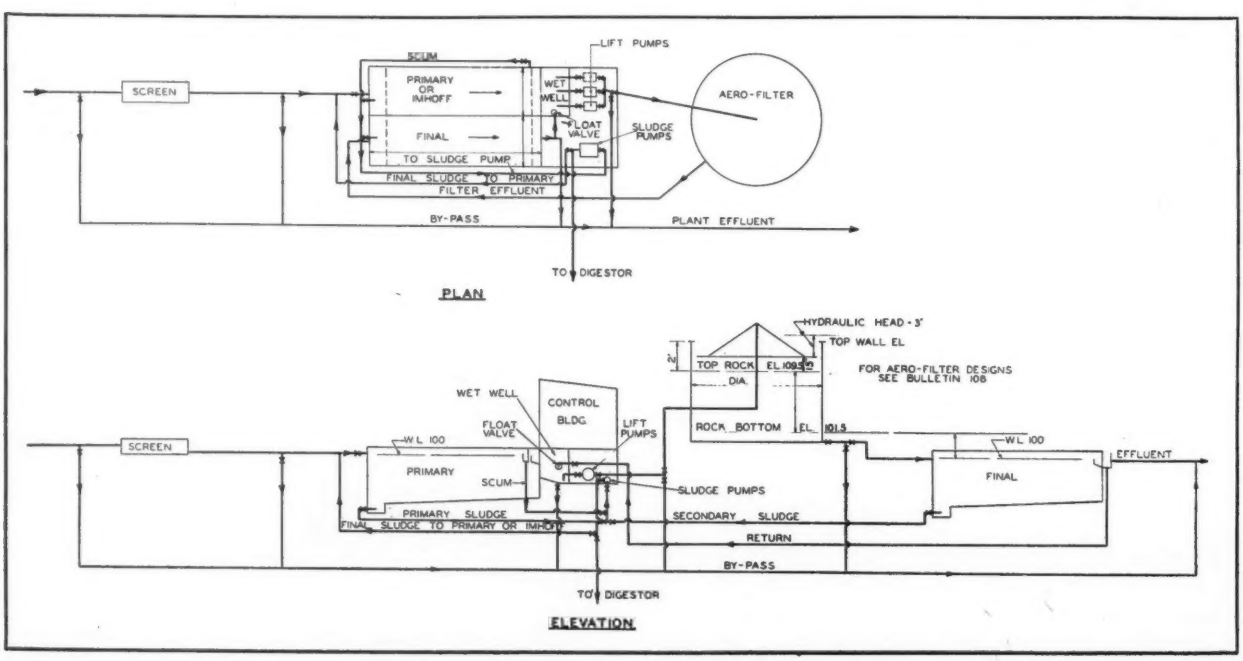
(Continued from page 13)

capacity of 7,500 cu ft. This would be obtained most economically in a tank of the following dimensions:

Diameter	25′0″
Side water depth	14′3″
Cone depth	3′0″
Freeboard	18″

If 3 cu. ft. per capita were provided, approximately 3′ would be added to the side wall depth. If the tank is unheated, the 25% to 50% additional capacity called for by the engineers would add 3′6″ to 7′ to the side wall depth.

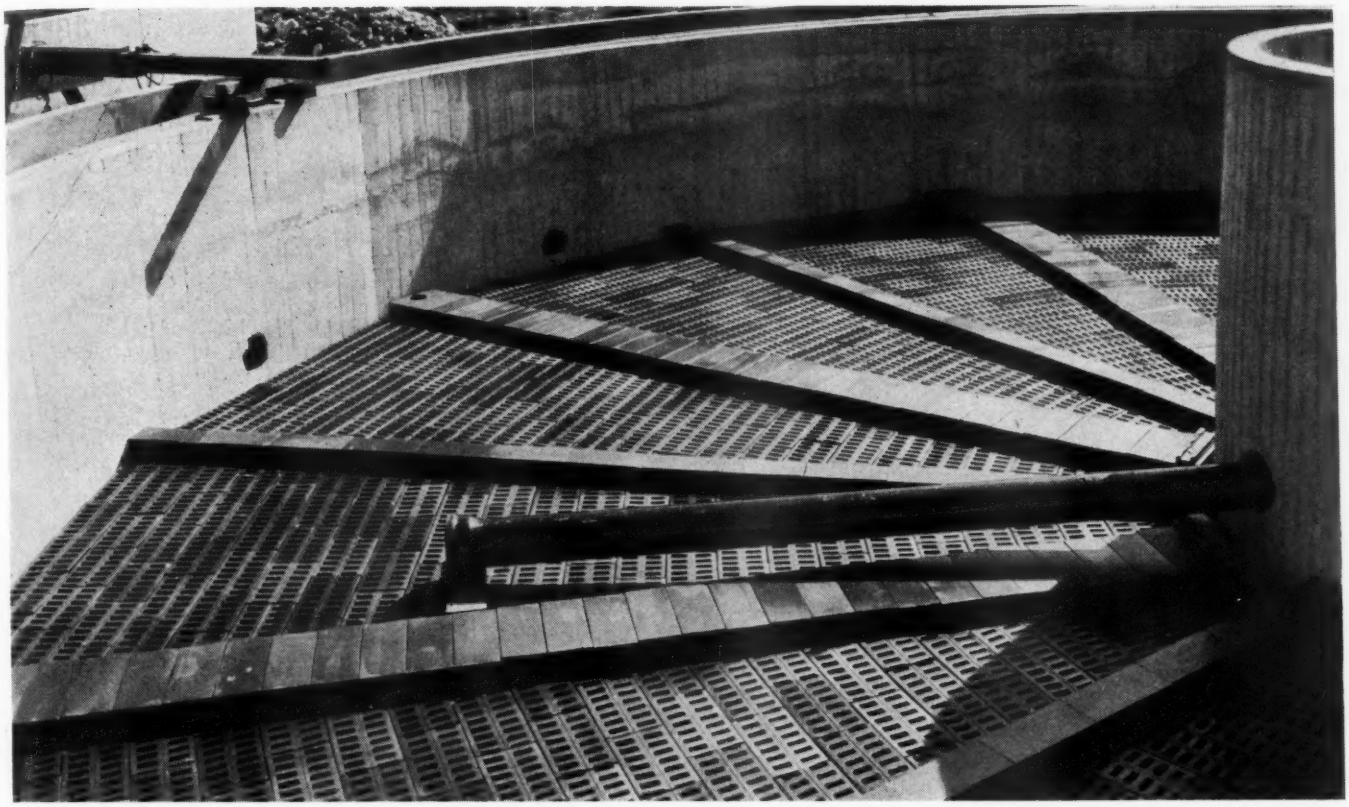
The gas should be collected from the digestion tank and passed through drip traps, flame traps and to a gas-fired boiler for heating the digester. (A gas engine probably would not be used for a plant of this size and nature.) Excess gas should be carried through



Typical single-stage aero-filter plant, Lakeside Engineering Corp.

ARMCRE Underdrainage System Speaks For Itself

A Complete Floor!



ARMCRE Meets All Underdrainage Requirements for Trickling Filter Disposal Plants

A ONE PIECE UNIT

MANUFACTURED FROM FIRE CLAY, VITRIFIED AND SALT GLAZED

ADEQUATE AIR SUPPLY

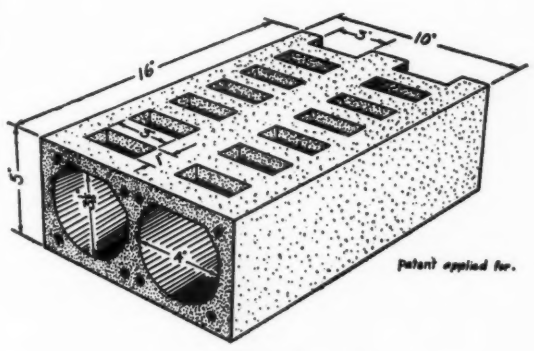
RAPID DISCHARGE OF EFFLUENT AND FILTER UNLOADING

EXACT ALIGNMENT OF DRAINAGE DUCTS

ACCESSIBILITY FOR INSPECTION

PERMANENT

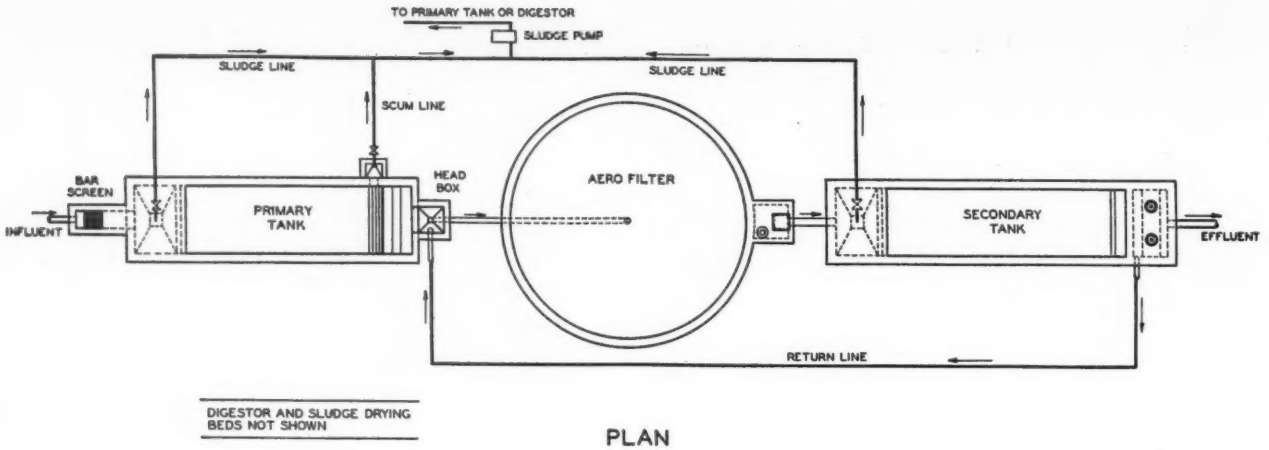
ECONOMICAL



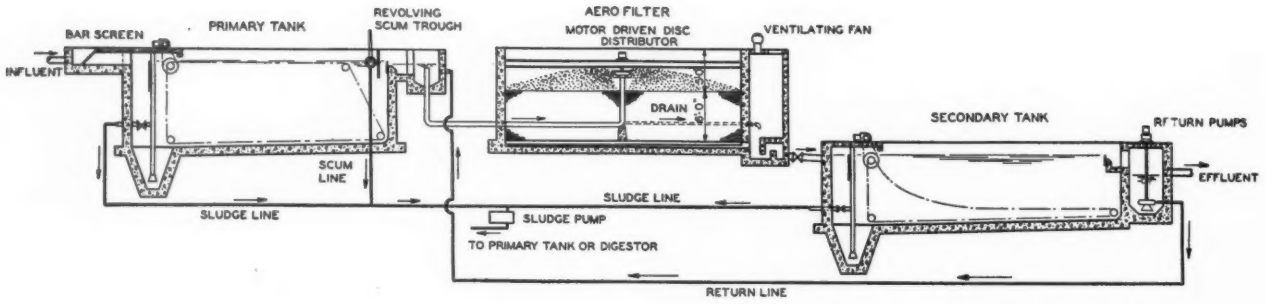
SIZE 5" x 10" x 16"

AYER-McCAREL-REAGAN CLAY CO.

BOWERSTON, OHIO BRAZIL, INDIANA ADEL, IOWA



PLAN



PROFILE

TYPICAL AERO FILTER PLANT FOR AIRPORT

(2500 POPULATION)

a pressure-relief waste-gas flame trap to a waste-gas burner. If the gas is not used for heating, all of it should be burned in a waste-gas burner to eliminate odors and explosion hazard.

A combined sedimentation and digestion tank is furnished by the Dorr Co. under the name "Clarigester." In this, a single circular tank is divided by a slightly conical horizontal floor into two parts; the upper of which serves as a sedimentation tank, the lower as a digestion tank. A vertical shaft in the center carries a set of horizontal rake arms at each floor level, the blades on the upper one pushing the sediment to the center of the upper floor, where it falls through an opening into the digestion tank, while the lower blades push the digested sludge to the sludge outlet. The shaft also carries scum breaker arms directly under the upper floor, and a skimmer arm to remove the scum from the top of the sedimentation tank. Gas is collected in a gas dome. For the plant assumed here, Dorr Co. recommends a Clarigester 28 ft. diameter by 20 ft. deep, the upper compartment being 7 ft. deep and the lower 13 ft. deep. This gives digestion tank capacity of 7,285 cu. ft. or 2.9 cu. ft. per capita.

Low-Rate Trickling Filters

For low-rate trickling filters the Report recommends not to exceed 5,000 population per acre-foot in the south and 4,000 in the north. This would give, for 2,500 population, 0.5 acre-foot in the south and 0.625 acre-foot in the north; or 21,780 cu. ft. and 26,245 cu. ft. respectively. With 6 ft. depth of stone this would give 3,630 sq. ft. and 4,374 sq. ft of filter. With 8 ft. depth the areas would be 2,723 sq. ft. and 3,281 sq. ft. respectively. These would probably be circular filters served by rotary distributors. Standard lengths of distributors would probably be used, which would be, for 6 ft. of stone, 70 ft. diameter and 80 ft. respectively; and for 8 ft., 60 ft. and 70 ft.

Bio-Filter Plants

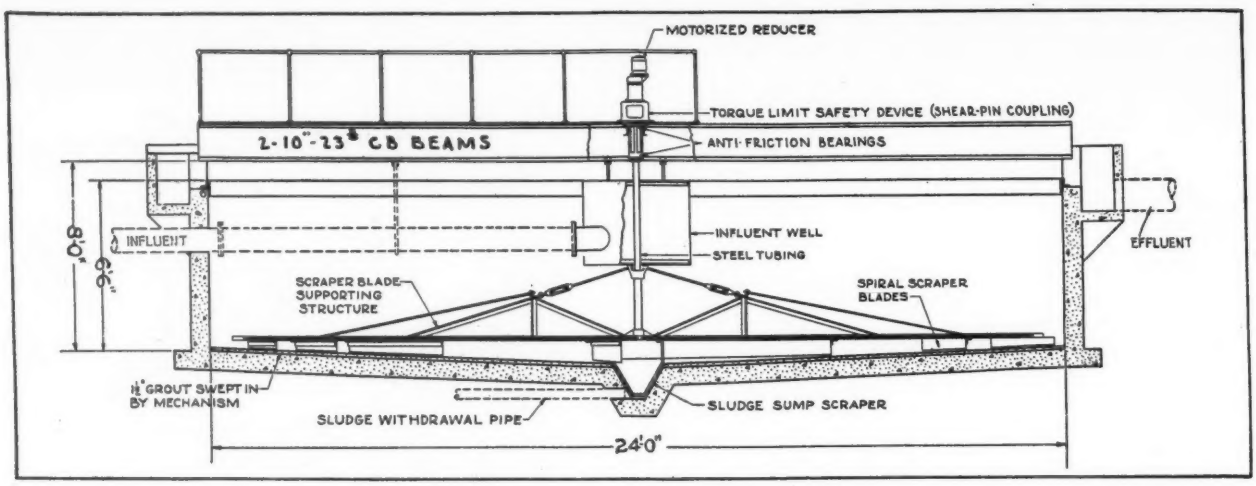
These are furnished by Link-Belt Co. and The Dorr Co. The former describes the plant and the procedure of designing as follows: Sewage flows by gravity through primary tanks into a sump, from which it is pumped to a primary filter, from which the effluent returns by gravity to the primary tanks. When the flow through the primary sump exceeds twice the average flow, the excess flows over a weir into a secondary sump and is pumped to the secondary filter, from which it flows by gravity part to the secondary tank and part to the effluent. All sludge from the secondary tank is returned at a uniform rate to the influent of the primary tank.

The B.O.D. load at 0.17 lb. per cap. gives 425 lb. per day The filter load is assumed as 2 lb. per cu. yd. of filter medium, so 213 cu. yd. of filter stone will be required. This is made 3 ft. deep, so the total filter area is 213 sq. yd. or 1,917 sq. ft.; obtained by two circular filters each 35 ft. diameter. (This is on the basis of the B.O.D. loadings of the Report, but the company recommends a load about double this for airports.

A recirculation ratio of 2 is assumed for the primary filter, so that the total flow through the primary tanks will be three times 175,000 gpd, or 525,000. With 2½ hours detention this gives tank capacity of 7,280 cu. ft. Depth is taken at 10 ft. and two tanks, each 10 x 37 ft. give this.

A recirculation of 1 is assumed for the secondary

When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 63-65



Primary setting tank, International Filter Co.

tanks, giving 4,860 cu. ft. capacity, obtained by two tanks each 8 ft. x 34 ft.

The recirculation pumps for the primary and final tanks have a capacity of 350 gpm, based on a daytime flow of 100 gpd per capita with ratio of 2; there being four pumps—a spare for each unit. Two of these pumps have variable speed motors so that the recirculation ratio can be varied at will. The effluent is chlorinated, the contact tank having a 15 min. detention period.

Aero-Filtration Plants

These plants are furnished by the Chain Belt Co. and the Lakeside Engineering Corp. The plant consists of a primary tank, aero-filter and secondary tank. The calculation furnished by the Chain Belt Co. is as follows:

Passing through a hand-cleaned bar screen with 1" clear openings between bars, the sewage enters the *primary tank*. This, with 3 hr. detention capacity based on average flow, would have a capacity of 3,000 cu. ft. Assuming 8 ft. average water depth, the area would be 375 sq. ft. Use a tank 10' wide x 38' long x 8' average water depth.

Aero-filter. Assume 30,000 population per acre-foot of stone. Then $\frac{2,500}{30,000} = .0833$ acre-feet $= 3,630$ cu. ft. $= 132$ cu yd.

Assume a maximum hourly rate of 245 gpm (double the average).

Assume a filtering rate of 26 mgd per acre. This requires 616 sq. ft. area $=$ 28 ft. diameter.

Then $\frac{3,630 \text{ cu. ft}}{616 \text{ sq. ft.}} = 6$ ft. depth of stone.

Final tank. With 2.25 hrs. detention based on average flow, 175,000 gpd $= 1,025$ cu. ft. per hr. $= 2,306$ cu. ft.

Assume 8 ft. average water depth; then $\frac{2,306}{8} = 288$ sq. ft. area.

$\frac{175,000 \text{ gpd}}{288 \text{ sq. ft.}} = 610$ gal. per sq. ft. per day.

Use a tank 9' wide by 32' long by 8' average water depth.

Recirculation. Best results are obtained if a continuous flow onto the bed is maintained; and it should never fall below 13 mgad—in this case 123 gpm. The raw sewage flow will fall below this rate during certain parts of the day, when it will be necessary to return plant effluent to the filter to maitnain this minimum rate. Two 60 gpm return pumps should be installed, so operated by float control that if the flow drops below 120 gpm one pump cuts in, and if it drops below 60 gpm both pumps cut in. Since these pumps handle plant effluent only, they may be of the clear water, high-efficiency type.

Ventilation. Forced draft ventilation is recommended; one cu. ft. per min. per sq. ft. of filter area $= 616$ cu. ft. per minute. A 12" fan using ⅛ h.p. motor will suffice.

Distribution on filter. Uniform and continuous distribution on the bed is of utmost importance. For a 28 ft. bed this is obtained with a power-driven disc distributor.

The filter media should comply with the following specifications:

Passing a 4" mesh	at least 95%
Retained on a 3" mesh	45 to 65%
Retained on a 2½" mesh	not less than 95%
Passing a 2½" mesh	not more than 5%
Passing a 2" mesh	not more than 1%

A *Sludge pump* of about 50 gpm should be provided to pump primary sludge to digester and secondary sludge to primary tank or direct to digester.

The Lakeside Engineering Corp. follows a somewhat different method in designing an aero-filter plant. They base their calculation on a population of 3,000 to be on the safe side, giving 210,000 gpd, with a maximum rate of twice this, or 290 gpm.

Filter. B.O.D. load $= 0.17 \times 3,000 = 510$ lb. Less 40% removed by tank $= 306$ lb.

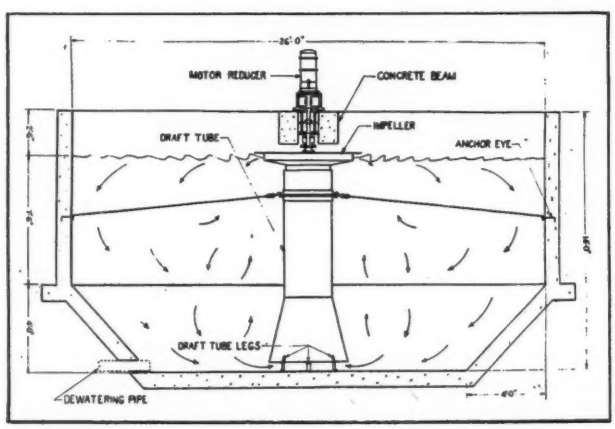
Assuming 2.25 lb. of B.O.D. per cu. yd. of stone: $\frac{306}{2.25} = 136$ cu. yds. stone required.

Assuming 18 mgad to filter as average, then the filter area is 531 sq. ft. Use 26 ft. diameter of filter. $\frac{136 \times 27}{531} = 6.9$ ft. depth. Use 7 ft.

Primary clarifier. Assume overflow rate of 1200 gpd per sq. ft. at maximum rate of flow (290 gpm), and 1.5 hr. detention time. Then area of clarifier $= \frac{420,000}{1200} = 350$ sq. ft.

Volume of clarifier $= \frac{2 \times 210,000 \times 1.5}{24 \times 7.5} = 3500$ cu. ft.

Final clarifier. Assume overflow rate of 1,000 gpd per sq. ft. Then calculation as for primary gives 420 sq. ft. area, 3500 cu. ft. volume.



Aeration tank for activating sludge, International Filter Co.

Pumps. If pumping is required, three pumps for each stage or variable flow pumps will fill the needs. Pumps should be installed which will provide flows of 13, 24 and 36 M.G.A.D.; in addition, a return pump should be provided for each stage of operation with a capacity of 13 M.G.A.D. The return pumps should be cross connected electrically to the main lift pumps so that when the main lift pumps are not operating the return pump will function.

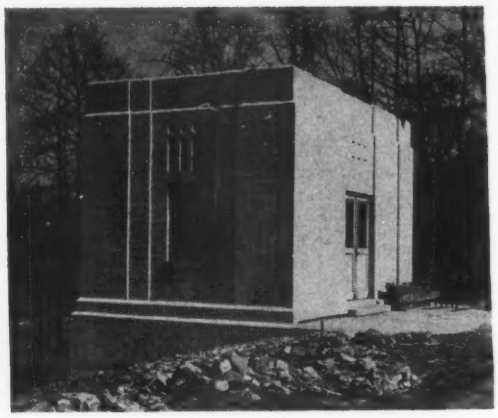
Activated Sludge Plant

The International Filter Co. suggests the following design procedure, using mechanical aeration: Primary settling tank 24′ diameter, side water depth of 6′-6″, giving tank volume of 22,000 gal. and detention period of about two hours; equipped with semi-automatic skimmer.

Aeration tanks. Two, each 26′ square with water depth of 7′-6″ to the top of a hopper 4′ deep, provide total tank volume of about 106,000 gal., giving detention of 8 hrs. based on average design flow rate plus 25% for return activated sludge. Two 3 hp motor activators required. Also two centrifugal pumps, one for return of settled activated sludge to the aeration tank, the other for the return of mixed liquor from the aeration tank to the primary sedimentation tank to facilitate wasting excess activated sludge.

Final sedimentation tank 24′ diameter, side water depth 8′, providing detention of 2.5 hrs. at average flow rate.

Digestion tank 24′ diameter, side water depth 19′6″, giving 3.5 cu. ft. per capita. A 40 gpm single-plunger pump will remove sludge from sedimentation tanks to digestion tank.



Gate house at sedimentation tank of Ashland, Ky., waterworks.

The Waterworks Digest

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.

HOW TO FIND ORIGINAL ARTICLES. Key letter at end of each digest refers to name of publication listed in bibliography at end of this section. Numeral indicates title of article.

Bacterial Corrosion of Iron

Sulfur bacteria exert corrosive action on iron in two ways: One type lives anaerobically and produces hydrogen sulfide by reduction; the other, living aerobically, produces sulfuric acid by oxidation. Both end products cause corrosion of cast iron and steel. Under varying outside conditions these processes may follow each other. Corrosion may also be caused by organisms oxidizing ammonia to nitrite and by oxidizing nitrites to nitrates, and the nitrous and nitric acids corrode the pipes under the slimy sludge formed by the organisms.[A19]*

Cross-Connections Pollute Supply

At the Golden Gate Exposition there was a domestic supply from San Francisco distributed through one piping system and a fire supply, the two being cross-connected at 4 points, where valves in pairs were supposed to be closed if water was pumped from the highly polluted bay to fight a large fire. On Aug. 24, 1940, a serious fire required use of the salt bay water; and although it was asserted that the valves were closed, the domestic supply was highly polluted, showing 16,700 ppm chlorides in one sample, while the normal content is only 9. Within 2 hrs. after the presence of salt in the domestic supply was noticed the Health Dept. had begun chlorinating the mains, and 13 hrs later the supply was pronounced safe again. Meantime, use of the water had been ordered discontinued and the Exposition officials delivered safe water by truck to the restaurants. The Dept. of Health had protested against constructing the cross-connections but the Exposition officials had insisted on installing them.[A4]†

Shrimps in A Water Supply

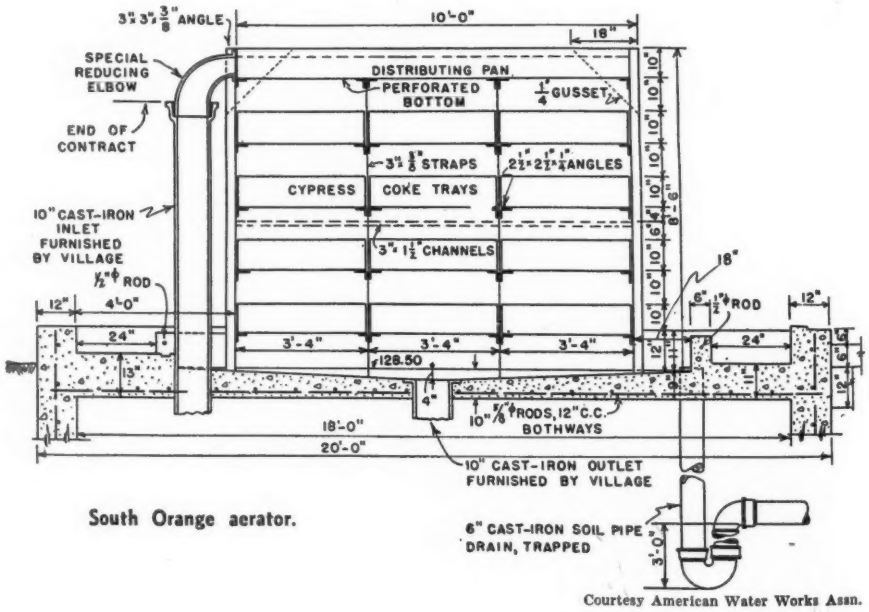
In Menominee, Mich., consumers on the outer portions of the distribution system found fairy shrimps or *Phyllopoda* discharged from their faucets. The shrimps were removed from the mains by flushing hydrants. The only reasonable guess as to how they reached the pipes is that their eggs passed the filters—it seems improbable that the adults could have done so, although many were found on the filters.[A7]†

Hexametaphosphate In Control of Corrosion

Prevention of precipitation of calcium carbonate by adding 1 or 2 ppm of sodium hexametaphosphate to water is called "threshold treatment" because its presence seems to stop the growth of crystal nuclei on the threshold of crystallization, probably due to the adsorption of a very thin film of metaphosphate on the nuclei which prevents further precipitation upon them. Such films also form on metals and metal oxides. The formation of films on pipes stops corrosion; its rate of formation depends on the amount of metaphosphate coming in contact with the pipe—the higher the concentration *or* the greater the amount of water passing through the pipe, the more rapid the film formation. A dose of 0.50 ppm of Calgon was found effective in controlling cold water corrosion. In passing through filters, 55% of the phosphate was lost, coated the sand and caused hard spots; best to apply it after filtration. It loosens old iron and manganese deposits on pipes in the distribution system, causing dirty water; this can be minimized by using small doses at first. Calgon has a stimulating action on the metabolism of some bacteria.[X6]*

Aerator At South Orange, N. J.

The water softening plant at South Orange, N. J. is believed to be the first municipal plant in which synthetic zeolite was used. At first the zeolites lost capacity rapidly because of the high CO_2 content (30 to 45 ppm). Aeration greatly decreased this and the amount of soda ash and silicate required. In September 1940 aeration reduced the CO_2 from 43.0 to 8.0 ppm. The aerator consists of four super-imposed trays filled with coke, each tray being made up of 15 boxes with copper wire cloth bottoms containing 10" depth of coke. The water is distributed by a perforated pan placed above



South Orange aerator.

Courtesy American Water Works Assn.

* See Bibliography in February issue.
† See Bibliography in January issue.

FRED STUART, *President*

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is a very powerful water works coagulant, recognized as the coagulant to use when dealing with waters which are difficult to handle — *fast being recognized as America's most popular coagulant.*

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is the only coagulant manufactured containing powdered activated carbon. This coagulant is recognized as the most efficient available for water works practice, *because it will actually remove tastes and odors from water supplies.* It is made from Standard ACTIVATED ALUM and costs $2 per ton more because of its activated carbon content. Truly the "Alum of Tomorrow available Today" for those who demand the best in Everything.

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NEWPORT NEWS, VA.	WASH. SUB. SAN. DIST.
WASHINGTON, D. C.	BELOIT, KANS.
COLUMBIA, S. C.	TUSCALOOSA, ALA.
CHARLOTTE, N. C.	GREENSBORO, N. C.
HAGERSTOWN, MD.	ALBANY, N. Y.

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Trenton, N. J.	Fredericksburg, Va.	Niagara Falls, N. Y.
Baltimore, Md.	Cincinnati, O.	Salem, Mass.

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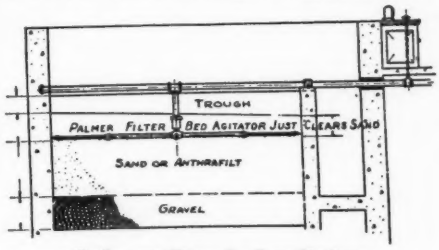
PALMER FILTER BED AGITATORS

Developed at Erie, Pa., by C. E. Palmer—acclaimed as the latest and best method of improving practice and cutting costs. 75 new installations in January, and over 400 now in service in waterworks and industrial plants of every size.



Palmer filter bed agitator

USERS REPORT

- Complete elimination of mud balls
- No more cracking or shrinking of beds
- Less wash water required—averaging 40% reduction
- Sand is clean—like new sand, after about three weeks' operation
- Longer filter runs
- Better tasting water—because the filter sand is really clean
- Reduction of chlorine demand in filtered water—because of removal of organic matter in the filter sand

BLEACHING CLAY

—Aids coagulation
—Increases absorption of organic matter
—Costs less than $20 per ton on the average
• Where absorption is indicated, bleaching clay is the answer.

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- ☐ Factors in Coagulation
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Name .....

Title .....

Company .....

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When you need special information—consult the *classified* READER'S SERVICE DEPT., pages 63-65

the topmost tray. The total area of the filters is 189 sq. ft. The aerator is enclosed in a building 18 ft. square with a pyramidal roof, the walls of which contain 68 removable "Dustop" air filters 20" sq., and an "Effico" automatic wind-electric ventilator 24" diameter is set in the apex of the roof, designed to provide as much air movment as wind at 5 mph. The ventilator is not operated if the wind velocity is high.[A 29]

Venezuela's Water Works Laboratory

The Direction of Sanitary & Hydraulic Works of Venezuela maintains a water analysis laboratory that occupies five ample rooms in Caracas and is equipped with modern facilities for complete bacteriological, plankton, mineral and sanitary-chemical examinations of water and sewage; also for carrying out experiments in water treatment, analyzing sand, testing meters etc. Long distance shipping of sample bottles is done mainly by airplane.[A 30]

Caustic Soda For Increasing pH

To increase the pH of its water from 6.5-7.5 to 8.2, Highland Park, Mich. uses impure caustic soda known as caustic bottoms containing a guaranteed 87.6% NaOH. It comes in steel drums as a solid weighing 750 lb. The drum is cut away and the caustic dissolved in about 3 times its volume of water and diluted to a solution containing 10% NaOH. A "Micromax" pH recorder - controller controls the application automatically and makes a continuous record of the pH value of the treated water. When the controller has been set for any desired pH value, if the pH of the water differs from this the potentiometer circuit of the recorder-controller is unbalanced and the controller, operating through a relay detector, actuates a reversible motor drive which changes the feed value position until the desired pH has been obtained. Thus both variations in the chemical strength of the solution and changes in the pH of the water being treated are automatically controlled.[A 31]

Repairing Meter Thrust Roller Slots

The Memphis, Tenn. Water Division has repaired about 3,000 ⅝" meters by inserting a stainless steel thrust roller guide or channel in worn slots of the measuring chambers. In one case—a 13-yr.-old meter — the registration was increased from 95.7% to 100% at 16 gpm flow, from 80% to 102% at 1 gpm, and from 0 to 94.6% at ¼ gpm, and registered on 1/16 gpm. The author believes that, using this device, measuring chambers that have become defective at the thrust roller slot only can be kept in service almost indefinitely, performing with amazing accuracy.[G 11]

Sand In Well Water

Intermittent withdrawal of water from a well is a main cause of sand in it. Separating out sand from water has been tried at Houston by tanks with upward flow and top discharge (failure); sudden enlargement in well discharge lines (failure); circumferential flow in 137 ft. circular tank of 2 mg capacity at 6,000 gpm (partially successful for large sand particles). Success obtained with a mechanically operated screen with provision for cleaning by back washing, with head loss under 10 ft., using 200-mesh stainless steel screens in a conical cylinder on a vertical shaft revolved slowly by a 5 h.p. motor.[X 17]

Installing Services By Drilling Method

In installing service connections and small mains, Paris, Ill. last July drilled horizontal holes for them in the ground instead of digging trenches, using a drilling machine operated by two men. All holes ran very true to line, the maximum deflection from the point aimed at being 4" and most being within 1". The holes varied from 16 ft. to 112 ft. in length, averaging 65 ft. The cost averaged 6.7 cts per foot. Speed averaged 22 ft. per hour. The two men operating the machine received 65 cts per hour each.[G 13]

Bibliography of Waterworks Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

A *Journal, American Water Works Assn. February*

21. How to Make a Motion Picture of the Water Works. By W. V. Weir. Pp. 201-212.
22. Flood-Forecasting Service in Pennsylvania. By J. W. Mangan. Pp. 213-218.
23. Financing of Extensions in Los Angeles. By E. F. Dandridge. Pp. 219-223.
24. Application of the Hardy Cross Method to Distribution System Problems. By G. Farnsworth and A. Rossano. Pp. 224-233.
25. Flow and Loss of Head in Distribution Systems. By J. J. Doland. Pp. 234-236.
26. *t.* Computation of Equivalent Lengths of Parallel Pipe Systems. By W. E. Howland and F. Farr, Jr. Pp. 237-245.
27. *t.* A Rapid Method for Determining Zinc in Water Supplies. By M. L. Riehl. Pp. 246-248.
28. Super-Chlorination and De-Chlorination. By M. C. Smith and H. E. Lordley. Pp. 249-254.
29. Zeolite Softening at South Orange, N. J. By R. S. Weston. Pp. 255-276.
30. The Water Analysis Laboratory of the Public Works Ministry of Venezuela. By J. M. Sanchis. Pp. 277-285.
31. Corrosion Control by pH Correction. By I. L. Dahljelm. Pp. 286-292.
32. Corrosion Experience at Richardton, N. D. By L. K. Clark. Pp. 293-298.
33. Corrosion Experience at Orange, Va. By R. L. Blankenship. Pp. 299-301.
34. Corrosion and Cathodic Protection. By G. H. Montillon. Pp. 302-308.
35. Metal Protective Finishes. By J. A. Meacham. Pp. 309-314.
36. The New River Decision by the U. S. Supreme Court. Pp. 315-342.
37. Water **Works Practice.** Committee Report. Pp. 343-364.

E *Engineering News-Record January 30*

5. *p.* Distribution System Records. Pp. 42-43.

F *Water Works Engineering January 29*

16. Large Steel Tanks of Small Height. By J. W. Clay. Pp. 118-119, 144.
17. Softening Colorado River Water. Pp. 120-123.
18. Diesel Pumping Unit Reduced Power Cost 75%. Pp. 127-129.
19. Laying Distribution Mains. Pp. 130-131, 146.

February 12

20. Automatic Chlorination of Open Reservoir Flow. By G. L. O'Brien. Pp. 172-175.
21. *p.* 11-Year Operating Experiences With Zeolite Softening. By R. S. Weston. Pp. 179-181, 200-204.
22. *p.* Is 25% Return on Cost of New Mains Fair? By R. Berry. Pp. 182-184, 204.
23. Is Federal License Required for Erection of All Dams? Pp. 185, 205.
24. Laying Distribution Mains. Pp. 187-188.

G *Water Works & Sewerage February*

9. Youth Studies Water Supply. (Research by Camp Fire Girls). By N. Walker. Pp. 65-67.
10. *p.* Accelerated Clarification. By F. J. Lammers. Pp. 70-74.
11. Solution of a Problem in Water Meter Repairing. By C. M. McCord. Pp. 75-78.
12. *p.* Superchlorination and Dechlorination. By M. C. Smith and H. E. Lordley. Pp. 82-84.
13. Main and Service Installations by the Drilling Method. By O. Gentry. Pp. 90-91.

J *American City February*

7. Softening and Filtration at Parkersburg, W. Va. Pp. 52-53, 79.

M *Canadian Engineer January*

9. Trends of the Past Year in Water Purification. By N. J. Howard. Pp. 13-15, 46-53.
10. Modernized Chlorination in New Toronto, Ont. By A. H. R. Thomas. P. 21.

P *Public Works February*

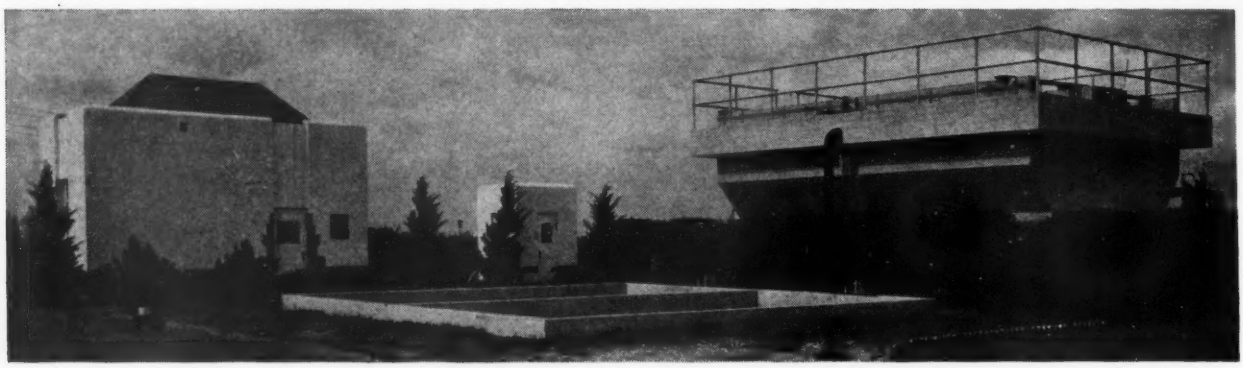
12. Manhasset-Lakeville Water District Reduces Pumping Cost 75%. P. 11.
11. Reducing Unaccounted for Water. By C. O. Thomas. Pp. 21-22, 24, 35.
14. How General Is Metering? Pp. 28, 30, 35.

W *Johnson National Drillers Journal January-February*

2. Ground Water: Description and Location of the Ground Water Provinces of the United States. Pp. 1-7, 10-12.

X *Proceedings, Texas Water Works and Sewage Short School*

1. Recent Developments in Water Softening. By H. L. Thackwell. Pp. 33-35.
2. The Georgetown Water Softening Plant. By J. Logan. Pp. 35-36.
3. The Problem of Iron Removal. By O. M. Bakke. Pp. 36-38.
4. Economics of Water Treatment. By L. C. Billings. Pp. 38-40.
5. Water Service Outside the City Limits. By K. F. Hoefle. Pp. 40-43.
6. Control of Tastes and Odors. By J. V. Kelly. Pp. 43-45.
7. The Water Superintendent as an Administrator. Pp. 45-46.
8. Interpretation of Bacteriological Analysis. By G. R. Herzik. Pp. 46-49.
9. Good Management Practice. By J. B. Dannenbaum. Pp. 49-53.
10. Water Works Requirements. By G. Hawley. Pp. 54-56.
11. Maintenance and Repair of Meters. By N. A. Miner. Pp. 57-58.
12. Rejuvenation of Existing Pipe Lines by Cleaning and Cement Lining in Position. By H. Harkness. Pp. 58-60.
13. Sanitary Precautions Required in Laying New Water Mains. By C. R. Harvill. Pp. 60-62.
14. The Water Works Rating System of the State Health Dept. By E. H. Pearl. Pp. 62-64.
15. Ozonization of Water. By S. C. Clark. Pp. 64-65.
16. Safeguarding the Water Supply. By C. C. Hays. Pp. 65-68.
17. Removing Sand from Well Water. By J. B. Dannenbaum. Pp. 68-70.
18. City Planning and the City Water Problem. By W. J. Powell. Pp. 71-73.
19. Long Term Planning of Water Works. By T. Bartlett. Pp. 73-76.
20. Conservation of Our Water Resources. By C. S. Clark. Pp. 76-81.
21. Obtaining the Good Will of the Customers. By G. M. Watson. Pp. 81-83. By G. J. Rohan. Pp. 83-85.
22. Operation of a Small Water Treatment Plant. By J. M. Lloyd. Pp. 86-90.
23. Sulfur Compounds in Water Treatment. By J. B. Chatelain. Pp. 90-94.
24. Water Problems in Sulfur Production. By J. B. Chatelain. Pp. 94-97.



Pump house and laboratory of the Rayne, La., sewage treatment plant. Imhoff tank at right.

The Sewerage Digest

Sludge Digestion At Davyhulme

This Manchester, England, plant contains 4 heated Dorr digestion tanks of 250,000 gal. capacity and 2 open secondary tanks 1,000,000 gal. capacity. These are supplied with a mixture of activated and primary tank sludges, 15 to 20% of the latter in summer and 30% in winter, the raw sludge being passed through a preheater in which it remains for 10½ hrs. in summer and 15 hrs. in winter. Enough gas is obtained to keep the heat in the digester above 80° F. Liquor is withdrawn from the primary tanks 6 to 12 ft. below the surface, and sludge from the bottom twice a week. During the years 1939-1940 the primary tanks received 248,230 tons of mixed sludge; of which 137,720 tons was withdrawn from the 6 to 12 ft. level and 103,620 tons from the tank bottom. Dry organic matter in sludge applied, 5,066 tons; in that withdrawn from the digesters, 3,669 tons; and in that from the secondary tanks, 3,080 tons. The sludge stayed in the tanks an average of 12.1 days. Gas produced, 3.4 cu. ft. per lb. of dry organic matter. Disposal of digested sludge — 65,420 tons at sea; 12,350 tons ploughed into the soil. The pH of the raw sludge averaged 6.7; of the digested sludge, 7.4; no foaming whatever occurred. Analyses show that sludge from the upper levels of the primary tanks is 65% digested, that from the bottom 75%, and the final secondary sludge 85%.[D 4] *

Treatment of Citrus Wastes

Precipitation with alum and lime produces a clear, alkaline liquid but one high in B.O.D., chiefly due to peel bin waste; therefore this should be excluded from sewers. Cooling water also should be excluded, thus reducing the quantity of waste water by two-thirds or more, or to 800 gallons per 1000 gal. of juice canned. This can be treated by chemical precipitation with low installation cost but high maintenance and poor B.O.D. removal efficiency; or by trickling filter with higher installation cost but low maintenance and higher efficiency.[X 16]

* See Bibliography in February issue.

HOW TO FIND ORIGINAL ARTICLES. Key letter at end of each digest refers to name of publication listed in bibliography at end of this section. Numeral indicates title of article.

Treatment of Dairy Wastes

The disposal problem is lessened by reducing fluid milk losses and excluding cooling and condenser waters. By-products such as whey, buttermilk, skim milk and drip milk should be recovered and sold. The septic tank is unsatisfactory except for small installations with subsurface disposal. Broad irrigation under favorable conditions is satisfactory. Chemical precipitation requires additional treatment. Activated sludge is still experimental so far as dairy waste is concerned. Biochemical or Guggenheim process is worthy of further consideration. Biological or trickling filters provide the most effective treatment in common use today.[X 18]

Progress In Waste Disposal

Progress in disposal of industrial wastes has probably reached an all-time peak, exemplified by recent process developments pertaining to recovery, waste treatment methods adopted, and continued industrial research on process wastes. "The ultimate solution to the industrial waste problem is to make it a part of industrial development." Plants in use for treating yeast wastes and distillery wastes are described; others to be described in later instalments.[H 13]

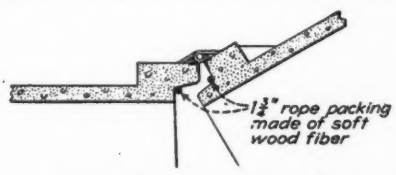
Sewage Plant Construction In 1940

During 1940, 258 sewage treatment plants begun in 1939 were completed and 336 projects were initiated. There are now in service approximately 5,700 plants, serving 55,000,000 persons; of which 4,135 serving 51,000,000 persons are modern and adequate. Thus, of the total urban population of the country, about 70% is served by treatment plants and 65% by adequate ones. Of the plants built in 1940, 84% were in cities and towns of 10,000 or less population.

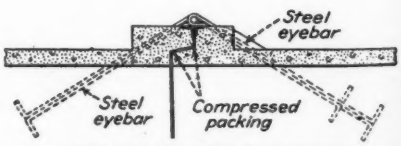
Of the 594 plants under construction in 1940, 517 were new plants, 47 were enlargements, 20 replacements and 10 repairs. Illinois was the state building the greatest number of new plants—65. New York is next with 33. Then come Ohio with 31; Minnesota, Missouri and Wisconsin with 29 each; Texas, 22; California and Pennsylvania, each 21. All the rest were below 20. Maine, New Hampshire and Vermont did no work on sewage plants during the year.[H 14]

Novel Outfall Box Sewer

Gentofte, Denmark, has built an outfall sewer 5,000 ft. long which has several unusual features. It is box-shaped, 10.17 ft. wide by 3.58 ft. high, divided by three vertical partitions into four chambers, each served by a separate 10,000 gpm pump, thus permitting a cleaning rate of flow whatever the total volume. The sewer is 15 ft. below water at the



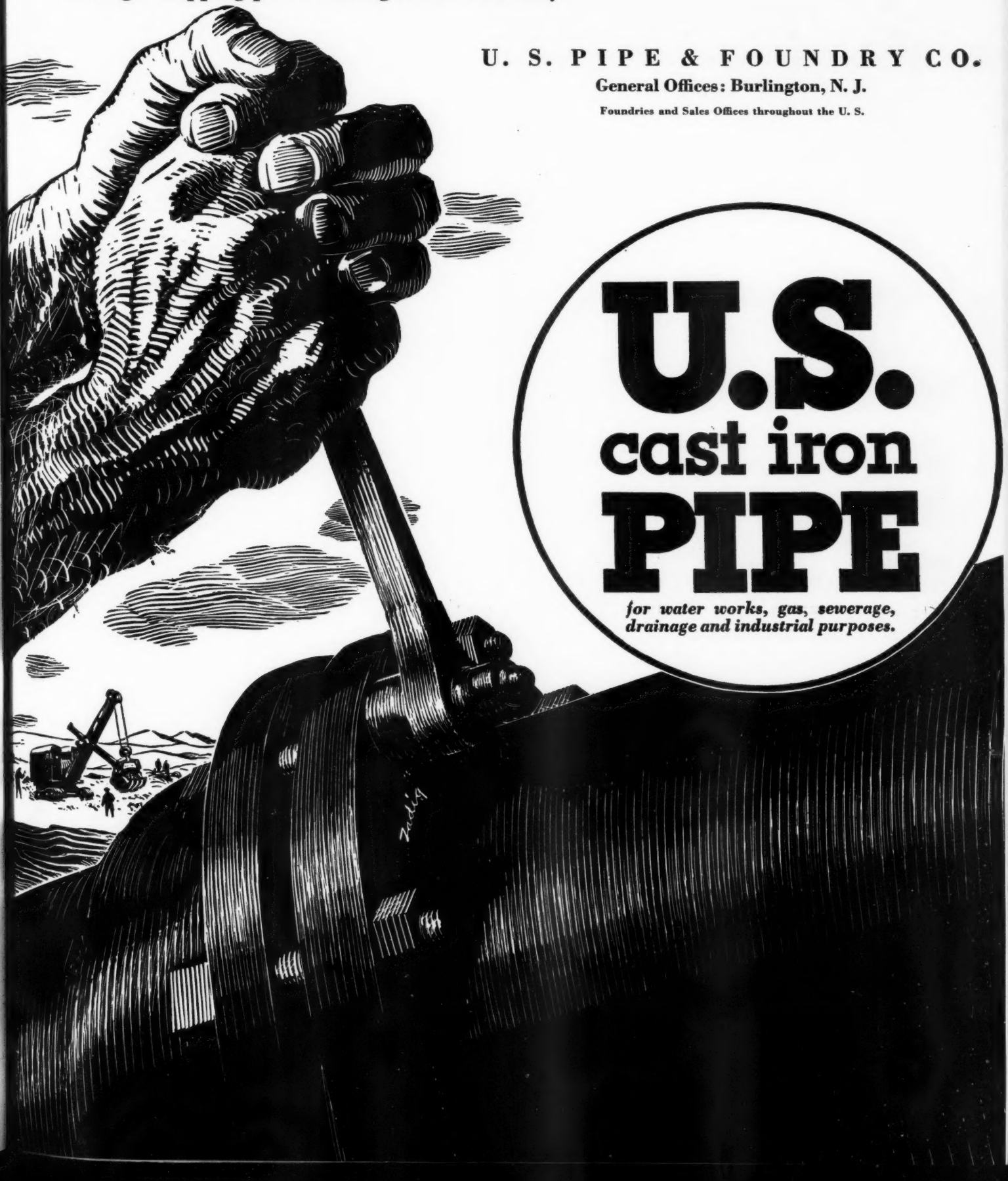
Establishing the Hinge Joint



Joint with Packing Compressed by Final Lowering of Rope

Hinge Detail Looking from Above

CONNECTING the pipe and assembling the joints is an easy, fast and foolproof operation with U. S. Mechanical Joint Pipe, resulting in a bottle-tight line. We have on hand large stocks of mechanical joint, bell-and-spigot and flanged Super-de Lavaud centrifugally cast pipe, pit-cast pipe and standard fittings in plant and storage yards at strategic shipping points throughout the country.



U. S. PIPE & FOUNDRY CO.

General Offices: Burlington, N. J.

Foundries and Sales Offices throughout the U. S.

U.S. cast iron PIPE

for water works, gas, sewerage, drainage and industrial purposes.

pumping station and 27 ft. at the outlet, laid in a trench 6 ft. deep backfilled with sand and a top layer of clay. The sewer was pre-cast on shore in 50 ft. lengths. A water-tight wooden cover was bolted to each end of a length and it was floated to position and lowered to place by two hoists on twin barges. Each unit rests on two concrete sills, one about 5 ft. from each end, set very accurately to grade.

The method of making the joint was one of the novel features. A steel eye bar was anchored into each side of each end, the eye projecting just above the top surface of the bell-and-spigot joint. When a unit was lowered to place, the rear end was kept lower and its top brought into contact with the unit already in place. With the eyes in line, a pin was slipped into each pair, thus forming a hinge at each side of the unit. The other end of the unit was then lowered to place, swinging around these hinges. To make the joint water tight, a 1¾" rope made of soft wood fibers was placed around the inner angle of each end of each unit, and when a unit was lowered into place the leverage around the hinges brought a pressure onto these ropes that compressed them into the consistency of solid wood.[E 6]

Sludge Disposal In New York City

The 350 mgd of raw sludge per year from the Wards Island plant are dumped at sea. The digested sludge from the Coney Island plant is barged to several of Brooklyn's park areas and pumped from the barge to the land, where it makes tight clay soils friable and adds moisture-holding capacity to sandy soils. In a remote section, 6 acres of sand fill are used as sludge drying beds, the sludge drying for 6 or 8 months and being shredded and used on parks, about 2,000 tons a year being so obtained. Soon sludge tanks mounted on automobiles will be in use to carry sludge from the Tallman's Island and Bowery Bay plants to sludge drying beds provided by the Park Dept., when about 4,000 tons a year of dried sludge will be available.

Screenings are worked and mixed by hand to make a mulch for use around trees and shrubs in the parks; this has little fertilizing value but is a good soil conditioner, and changes into a relatively rich black soil.[J 7]

Cleanout Manholes

Dallas, Texas, builds cleanout manholes like standard ones except that a cleanout wye is inserted in the sewer a few feet below the manhole and an inclined pipe carried from it to the manhole, entering the wall about 2 ft. below the ground surface, so that sewer rods can be inserted from the street without having to enter the manhole, making it possible to rod a stoppage even though the manhole is full of sewage. The wye and the inclined pipe for its entire length are supported by concrete. Cleanouts without manholes are constructed by placing a 27° wye in the main, pointing upward, placing in it a 6" sixteenth bend and enough 6" vertical pipe to reach street level.[X 10]

Refuse Incinerators Constructed In 1940

Twelve municipal refuse incinerators were constructed in 1940, four of them at sewage treatment plants; 7 by the Nichols Eng. & Research Corp., 3 by Pittsburgh-Des Moines, one by Morse Boulger and one by Geo. Allen & Son. The largest, 600 tons per day, was at Pittsburgh, Pa.; the smallest, 40 tons a day, at New Canaan, Conn. and Rock Island, Ill. The others were built by Akron, O., Athens, Ga., Fall River, Mass., Highland Park, Ill., Larchmont-Mamaroneck, Tonawanda and Watervliet, N. Y., Logan, W. Va., New London, Conn.[H 15]

Bibliography of Sewage Literature

The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

E *Engineering News-Record*
January 30
6. Novel Joint Simplifies Sewer Construction. By R. Hafdan-Nielsen. Pp. 58-60.

G *Water Works & Sewerage*
February
8. Developments and Trends in Sewerage Practices. By A. Wolman and A. H. Fletcher. Pp. 45-59.
9. Youth Surveys the Sewage Problem. (Camp Fire Girls). By N. Walker. Pp. 67-69.

H *Sewage Works Engineering*
February
12. Developments in Sewage Treatment—1940. By W. Rudolfs. Pp. 65-71.
13. Industry Abates Stream Pollution. By H. H. Black and C. W. Klassen. Pp. 74-79.
14. National Census of Sewage Plant Construction—1940. Pp. 80-87.
15. National Census of Refuse Incinerator Construction—1940. Pp. 88-91.

J *American City*
February
5. Sewage Treatment Housed With Refuse Disposal, Dover, Del. By T. R. Kendall. Pp. 44-46, 79.
6. Small Imhoff Plant for Wolfeboro, N. H. Pp. 54-55.
7. Sludge for City Parks. By R. Moses. Pp. 59, 61.

M *Canadian Engineer*
January
3. Sewage Treatment at Moose Jaw, Sask. By A. W. E. Fawkes. Pp. 18-19, 54.
4. Design and Operation of Grit Chambers. By A. E. Berry. Pp. 22-24, 53.

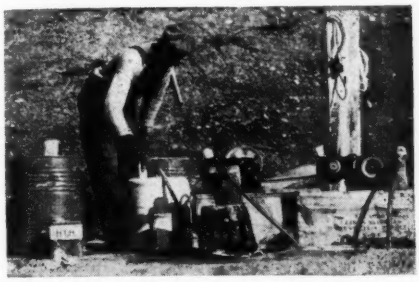
P *Public Works*
February
9. Sewage Treatment Plants for National Defense Projects. Pp. 9-10, 39-41.
10. Dewatering Sludge by Vacuum Filtration. By L. W. Van Kleeck. Pp. 14-16, 38-39.
11. The Sewage Treatment Plant at Winner, S. D. P. 37.

X *Proceedings, Texas Water Works and Sewage Short School*
Year of 1940
5. Arriving at Actual and Expected Sanitary Sewage Flows. By R. U. Andrews. Pp. 98-99.
6. The Design of Storm Sewers. By W. E. White. Pp. 99-103.
7. Aims in Sewage Treatment. By E. J. M. Berg. Pp. 103-106.
8. Characteristics of Sewage. By W. S. Mahlie. Pp. 107-109.
9. Operation Methods of Trickling Filters. By H. D. McAfee. Pp. 110-111.
10. Manholes, Cleanouts and Flushtanks. By R. R. Cooke. Pp. 111-113.
11. Inlets and Appurtenances. By C. G. Levander. Pp. 113-115.
12. Economics of Sewage Treatment. By W. A. Hardenbergh. Pp. 115-119.
13. Biofiltration. By O. V. Lindell. Pp. 119-120.

"Hurry-Up" Sterilization of New Laid Mains at U. S. Army Bases

31.8 miles of pipe made safe at new Army Training Camp, Joseph T. Robinson, Arkansas.

Tackling the job of sterilizing 31.8 miles of main ranging in size from 6" to 16" and doing it in a *hurry* is no small undertaking. Yet, it was completed in 56½ days—working under difficulty of an inadequate,



"Dis is de best job I'se had yet. I just mixes up that white powder and them little red pumps (Midget Chlor-O-Feeders) does all the work."

partly finished water supply part of the time—using Midget Chlor-O-Feeders pumping strong hypo solution into the new main — to produce a chlorine residual of approximately 50 ppm.

This job was performed by Lund Engineering Co., Little Rock, Ark., under the direction of the Engineers on the camp project, Black & Veatch of Kansas City, Mo., and supervised by A. V. Perry, their Chief Resident Engineer, and Charles F. Samuel, Water Supply Engineer, of Little Rock Water Department.

You're in the Army now! — All hydraulic Chlor-O-Feeder at Camp Robinson.

Mr. Alfred Lund specifically thanks us for our help and advice on this problem — he is certainly welcome and so are you for any "hurry-up" chemical feeding service we can render. Address, % Proportioneers, Inc. %, 96 Codding Street, Providence, R. I.

14. Control of Activated Sludge Plants. By M. Spiegel. Pp. 121-132. By W. Pralls. Pp. 132-133.
15. Correlation of Sampling, Sample Preservation, Sample Composition, Flow Measurement, and Analysis. By W. S. Mahlie. Pp. 134-138.
16. Disposal and Treatment of Citrus Fruit Canning Wastes. By C. H. Billings. Pp. 143-146.
17. The City's Sewage Problem and Its Relation to Industry. By W. Dilland. Pp. 146-148.
18. Treatment Methods for Creamery and Dairy Wastes. By V. P. Crockett. Pp. 148-151.
19. Paper Mill Wastes and Their Treatment. By L. F. Warrick. Pp. 151-156.
20. Treatment and Disposal of Oil Field Brine. By J. J. Rady. Pp. 156-159.

Acquiring Marginal Lands for Highways

(Continued from page 38)

damages; (3) in preventing excessive damage costs in present and future development; (4) in conserving property values and protecting public improvements; (5) in avoiding traffic hazards; and (6) in facilitating the conversion of main through routes into freeways.

Recoupment may be realized through the sale or lease of incidentally acquired property or the sale or lease of property specifically acquired under public land funds or authority. While recoupment acquisition when used in connection with the power of eminent domain may actually result in lowered costs for the improvement, such acquisitions should not be used indiscriminately since the success of the method depends upon the extent of the condemnation, the number of parcels involved, and the nature of the improvement.

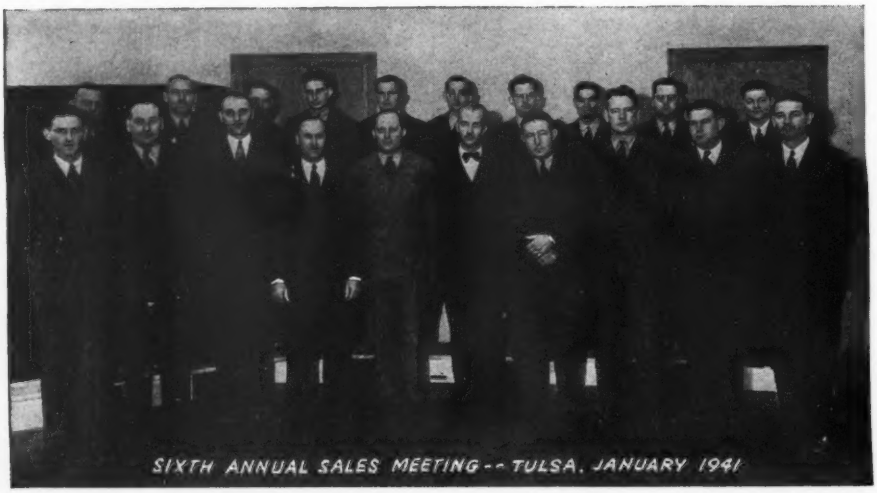
Although several States have constitutional authority which permits them to acquire excess lands under the power of eminent domain, and a number of States have statutory authority, investigations show that this power is being used only to a limited extent.

Up to this time the courts have dealt with the constitutionality of marginal land condemnations under limited conditions presented by specific cases rather than on the basis of the broad principles involved.

The increment tax and special assessments are other methods by which governmental agencies may recover part of the increased values resulting from a street or road improvement. The former has not been used extensively in the United States. Although special assessments are not employed as extensively now as they were 10 years ago, they are still being used in financing many street improvements.

The above is a very brief abstract from a discussion in "Public Roads," official journal of the Public Roads Administration, Federal Works Agency.

PEOPLE . . . *Here and There*



Front row, left to right: L. R. Van Arsdale, W. R. McLaughlin, F. A. Arnesen; Captain Higgins, Vice President and Sales Mgr.; J. L. Cottrell; A. J. Kerr, District Mgr.; A. D. MacLean, Vice President and Chief Engineer; Roy R. Bush; O. W. Barnett; Dean D. Collins. Back row, left to right: L. A. Babin, M. D. Gilbert, J. W. Northcutt, Herbert Parker, J. E. B. Lundy, Carl E. Baird, C. K. Madison, Glynn De Haas, F. N. Dillman, Tom Stacy.

Pittsburgh Equitable Holds Annual Sales Conference

During the week of January 6 the Pittsburgh Equitable Meter Company and Merco Nordstrom Valve Company salesmen in the Southwest gathered at the company's Tulsa plant for an intensive sales meeting. Many different subjects were covered pertaining not only to sales but also to engineering, according to A. J. Kerr, District Manager. Discussions were held on the company's various types of meters, regulators and valves used by the water, gas and petroleum industries.

Captain A. E. Higgins, Vice President in Charges of Sales, and A. D. MacLean, Vice President and Chief Engineer, attended from the company headquarters in Pittsburgh. Similar conferences are now being held in other districts.

W. R. Macatee, Ass't. Mg. Dir. Of Asphalt Institute

The Board of Directors of The Asphalt Institute has named W. R. Macatee to the newly created post of Assistant Managing Director, effective immediately.

Mr. Macatee has been serving as District Engineer with office in the Transportation Building at Washington, D.C., where he has effectively coordinated the Institute's work with national defense measures, particularly in the airport construction program.

Mr. Macatee will continue in charge of the Washington Office of the Institute.

Columbia Chemical Opens New Office

W. I. Galliher, Director of Sales of the Columbia Chemical Division, Pittsburgh Plate Glass Company, announced today the opening of a chemical sales office at 615 Johnston Building, Charlotte, North Carolina.

James R. Simpson, former Director of Duke University's Appointments Office, has been named District Sales Manager in charge of the Charlotte Office.

Roland Leveque With Phipps & Bird

Roland Leveque, superintendent of the city waterworks, Fredericksburg, Va., has resigned his position, effective April 1, to become an executive of Phipps and Bird Company, a chemical manufacturing and sales firm in Richmond.

Mr. Leveque is the first and only superintendent of the filter plant which Fredericksburg built in 1927. Since taking the post he has become a leading figure in the Virginia section of the American Waterworks Association and is now vice-president of the group.

President of Chain Belt Co. Passed Away

C. R. Messinger, President of Chain Belt Company, who has been continuously identified with Milwaukee and Chicago business interests for more than three decades, died suddenly of a heart attack on February 4, 1941, at his home in Milwaukee.

William E. Wright To Diamond

The Diamond Iron Works, Inc., Minneapolis, Minn., announces the appointment of William E. Wright as Sales Engineer for the company. Mr. Wright was formerly associated with the Austin-Western Co. and for the last three years has conducted an equipment business in Wisconsin.

The company also announces the transfer of Frank P. Blancett, district representative, from the Southwest territory to the East Central territory. Mr. Blancett, prior to joining Diamond about a year ago, was engaged in the equipment business in Zanesville, Ohio.

F. M. Gardner Joins Cooper-Bessemer

Furthering its territorial coverage of industrial and municipal power plant projects, The Cooper - Bessemer Corporation has recently announced the affiliation of F. M. Gardner with their diesel and gas engine sales department.

With his headquarters at the company's Mount Vernon, Ohio, offices, Mr. Gardner's territory in his new connection will include western Ohio, Indiana, Kentucky, and Tennessee, where he will represent The Cooper-Bessemer Corporation in the sale of its stationary gas and Diesel engines for municipal, industrial and government-sponsored power projects.

J. E. Pennybacker Passes Away

After an illness of several months he went to Delray Beach, Florida, with the hope that the change would be beneficial but the end came on February 25th, 1941.

After a wide and successful experience as economist for the Bureau of Public Roads, Secretary of the American Highway Association, Statistician for the Senate Committee on Post Offices and Post Roads, and other important work of the same nature, Mr. Pennybacker organized the Asphalt Institute in 1919 and was the managing director until his death.

Throughout his business career he adhered to the highest ethical standards. His loss will be keenly felt by those who knew him best.

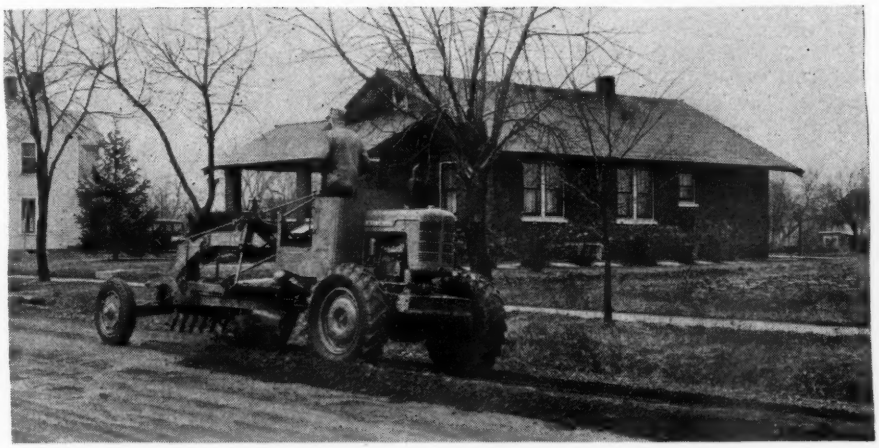
NEW OFFICIALS

Among the new City Engineers are:

C. H. Inman, Opelika, Ala.
R. E. Stallings, Tucson, Ariz.
Harmon H. Kellum, Trinidad, Colo.
Will Rogers, Clearwater, Fla.
Wilford W. DeBerard, Chicago, Ill.
Robert H. Cooks, Lincoln, Ill.
L. C. Johnson, Norton, Kan.
D. A. Rody, Pratt, Kan.
Frank J. McCarthy, Peabody, Mass.
Rasmus Jensen, Ludington, Mich.
J. J. Hiebert, Windom, Minn.
B. E. McDearman, Cleveland, Miss.
W. J. Cochran, Jr., Boonville, Mo.

(Continued on page 64)

Keeping Up With New Equipment



New Austin-Western No. 55 motor grader.

A New Grader

Austin-Western Road Machinery Co., Aurora, Ill.

A new motor grader, with hydraulic controls, for jobs that pay out better with a lower investment, without sacrificing the quality of work, has just been announced by The Austin-Western Road Machinery Co., Aurora, Illinois.

It is powered with a very fine 31 H. P. gas motor; weighs approximately 8000 lbs., and uses a sturdy, mono-rail, box-type frame that averages 50 lbs., to the foot. It has five speeds forward ranging up to 14.8 M.P.H. and a reverse speed. It is called the No. 55.

Scarifier and blade lift are operated by a smooth working, accurately built form of hydraulic control such as is used on machines selling at much higher figures. Side shift and circle reverse are hand operated from the cab; steering is very direct and highly efficient.

Other design features of interest include a wide front axle with ample ground clearance to straddle windrows; front wheels spaced to track with rear drivers; rugged draft beams with ball-joint connection; large diameter circle and heavily braced blade supports.

Standard equipment includes an 8-ft. blade, hydraulic wheel brakes and parking brake. (Electric starter, horn, lights, canopy-type cab, 10-ft. blade, V-type scarifier and snow plow are optional.)

Drainage Tile Data and Specifications

Three separate and distinct classifications are provided for drain tile by the American Society of Testing Materials. These classifications are *Extra Quality, Standard* and *Farm Drain* tile. For all airport, highway and other comparable drainage work, the Extra Quality tile should be used. It has a higher crushing strength and lower absorption than the other classifications. Moreover, where materials are buried underground and where service for many years is expected, products that have ample strength and durability should be preferred. All modern tile manufacturing plants can supply this product.

Specifications covering drain tile were written by the American Society for Testing Materials in 1914, and were last amended in 1924. These specifications carry the designation C4-24. In writing specifications covering drain tile, "extra quality drain tile, ASTM C4-24" should be required in order to obtain the most desirable quality for such work.

The DeLuxe Chem-O-Feeder

%Proportioneers, Inc.%

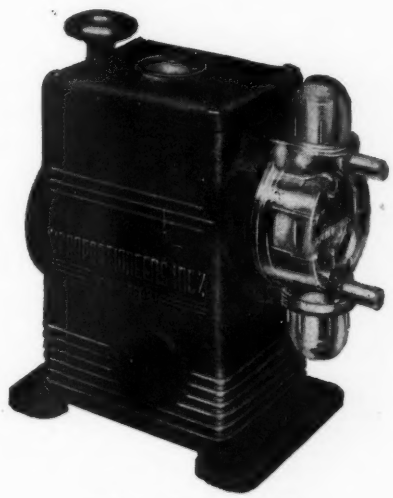
The manufacturers say this new machine is revolutionary in the fewness of its parts, the ability to change stroke length adjustment or chemical feed while in operation with stroke length indicator scale protected from dirt or oil by a "See-Thru" cover; high capacity of 10 gallons per hour of solution adjustable in an infinite number of steps down to nearly zero; totally enclosed and running in oil with top cover so that oil will *not* be lost when making interior inspections.

The "See-Thru" construction on the entire reagent head with built-in sight feeders makes the operation of the diaphragm, check valves and the movement of chmicals and entrained air visible to the operator.

%Proportioneers'% exclusive *Self-Compensating* diaphragm automatically corrects the chemical output to compensate for water pump flow variations.

The new stream-lined DeLuxe Chem-O-Feeder embodies the latest in good design and workmanship, handles practically every chemical for water and sewage plant operations and is universally applicable to all types of drive from electric motors, belts and pulleys or chain and sprocket which may be found necessary in various applications and uses.

This new feeder has practically CONTINUOUS INJECTION which is attained by quickening the suction stroke and elongating the discharge stroke so that 90% of the time elapsed is actual chemical feeding while only 10% is given to the suction stroke.



DeLuxe Chem-O-Feeder.

By the use of a dome type sight feeder with compression air trapped in the discharge dome the DeLuxe Feeder provides a damping action which smoothes out even the short 10% suction stroke.

This unit costs little more than the sturdy, reliable, "Little Red Pumps" which were its ancestors, but has everything a chemical feeder should offer.

A More Powerful Traxcavator

The Trackson Company, Milwaukee, Wisconsin, announces a new, more powerful "TRAXCAVATOR" mounted on the new "Caterpillar" D7 (75 H.P.) Diesel Tractor. The addition of this new model, known as the T7, makes these machines available in three sizes

with bucket capacities ranging from ½ to 2½ cubic yards. The T7, like the smaller model T2's and T4's, will do a variety of digging, loading and material moving operations, but on a larger scale. The manufacturer claims it combines in one machine the usefulness of a shovel, loader, scraper, bulldozer, ANGLEGRADER, trailbuilder, etc. The entire tractor drawbar horsepower of over 22,000 pounds push can be utilized for bucket crowd enabling it to penetrate and dig the toughest soils, clay, caliche, shale, and frost. It will strip, level and subgrade—load trucks and trailers—transport and load all kinds of bulk materials. The Model T7 is powered by the "Caterpillar" D7 Tractor equipped with extended track frames and specially fitted to give the power, stability and traction necessary for successful operation. Further details can be obtained from the nearest "Caterpillar" dealer or by writing Trackson Company, Milwaukee, Wisconsin.

T 7 Traxcavator.

A New Hypochlorinator

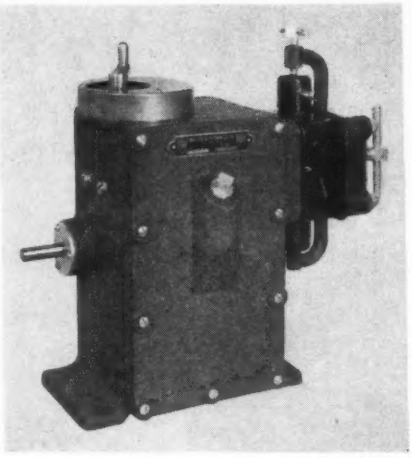
Wallace & Tiernan Co., Newark, N. J.

Wallace & Tiernan Co. Inc., announces a new belt driven unit in its line of Hypochlorinators. All of the features inherent in W&T equipment—accuracy, reliability and efficiency—are claimed for this addition to the line.

Because of the greatly increased need for safe drinking water in camps, construction jobs and out of the way places, it is believed that this new Hypochlorinator will meet with a large demand. It is particularly adaptable where water is pumped by gasoline engine or where there is a drive shaft or power pulley available to supply the necessary motive power.

Pumping is accomplished in the same manner as with other W&T Hypochlorinators using a somewhat heavier diaphragm. Gears and all moving parts run in an oil bath, providing ample lubrication at all times.

Operating at 720 r.p.m., the unit pumps 60 gallons of solution in 24 hours against a back pressure of 30 pounds per square inch. Adjustment is by a crank arrangement giving a range of capacities of 4:1, at constant shaft speed. Further, flexibility is provided by a change in shaft speed. Calibrations



Wallace & Tiernan Hypochlorinator.

are arranged so that the same ratio applies between maximum and minimum, regardless of speed.

Solution being pumped comes in contact only with materials such as hard rubber, silver and glass which are resistant to corrosive solutions. Its use, therefore, includes pumping many chemicals in addition to hypochlorite, such as any of the following: caustic soda, copper sulphate, acids, silicates, polyphosphates, iron salts, nitrites, coagulants.

For complete information, write to Wallace & Tiernan Co. Inc., Box 178, Newark, N. J.

Portable Asphalt Plant

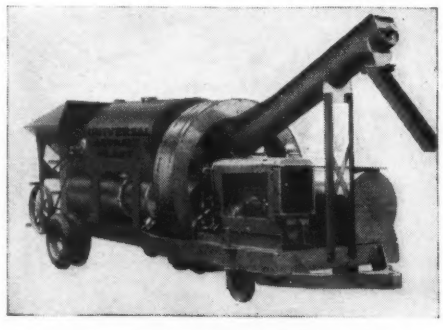
Universal Crusher Company

The manufacturer claims this plant produced up to 42 tons per hour of mixed asphalt, using 245 gals. of MC-2 asphalt road oil to one ton of aggregates. The specifications on the test job called for 30% to 40% gravel ¼" to ¾" and 60% to 70% sand ¼" minus.

In the test run the 230 gal. fuel tank supplying the dryer burners was filled only once in 5 days with distillate at 6½c a gal. Only 75 gals. of gasoline for power was used over a 5-day period.

The plant has a retractable trailer hitch so that it can be towed by truck or tractor. This is pushed under the frame, out of the way, when not in use. The plant is supplied materials by conveyor or fed directly from a bin.

It has a twin hopper from which



New Universal Asphalt plant.

material is metered by mechanical feeder to twin dryers—sand to one dryer and aggregates to the other. These rotary dryers are heated by oil fired burners. The heat that escapes from dryers is utilized to heat the asphalt in the 700 gal. tank above the dryers.

From the dryers the material is elevated by the Rotavator to the Screw Pug Mill. The tumbling and discharge action aerates the material, releasing steam and resulting in a dryer material.

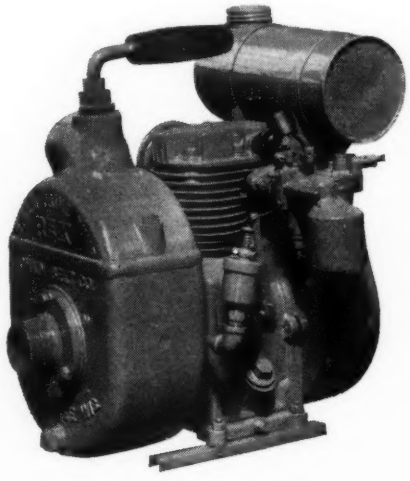
Hot oil is added in the Pug Mill and the agitator screws thoroughly cut, mix and blend the material at the same time conveying it to a swivel chute for convenient truck loading.

A New Light Weight Pump

Chain Belt Co., Milwaukee, Wis.

Chain Belt Company of Malwaukee announces the manufacture of "REX Junior," a new, light-weight, 3000 GPH centrifugal pump weighing only 54 pounds.

This 1½" pump contains all the engineering features of the standard line of Rex centrifugal pumps, including the famous, patented Rex "peeler," a device that actually peels the air from the whirling impeller and thus speeds up the prime. It has a large semi-steel recirculating water chamber equipped with an aluminum cap to save weight



Chain-Belt Rex Jr. Pump.

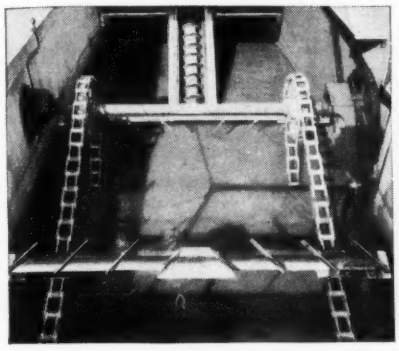
and is powered by a dependable, easy starting single cylinder, air cooled engine of ¾ to one horsepower.

The engine is equipped with an automatic governor that speeds up the motor when the pump catches its prime and starts to lift water. This eliminates the possibility of putting too much strain on the power unit at low speeds and assures economical performance.

This rugged little 3M water mover was designed mainly for the contractor to pump water for excavations and to keep seepage levels low on bridge jobs, etc., but has been found to fill the needs of municipalities and counties too.

The overall dimensions of 15¼" long by 11¾" wide by 15¾" high, com-

bined with a weight of only 54 pounds, makes it possible to pick up "REX Junior" with suction and discharge hose still attached, and carry it from job to job in the trunk compartment of an automobile, and it is an easy one-man job to swing "REX Junior" up onto a truck.



Link-Belt Grit Collector.

Grit Collector and Washer

Link-Belt Co., Philadelphia, Pa.

The Link-Belt Straightline Grit Collector and Washer for collecting, washing, and removing settled grit from sewage, is illustrated and described in Folder 1942 which Link-Belt Company, Philadelphia, the manufacturer, announces is now available for distribution.

This grit chamber equipment consists of a conveyor with pitched flights to turn the material over and over, and an inclined washing and dewatering screw into which the collector-conveyor discharges.

As the material handled is of an abrasive nature, conveyor chains with large abrasion-resisting wearing shoes are used. These slide on tracks provided with renewable wear-resisting steel flats.

The washing screw agitates the material brought to it by the collector, separates the grit from the organic material, and conveys it up the incline to point of discharge. The organic material is floated away by the current of water created and directed by baffles in the influent channel and by a corresponding baffle and cover plate over the screw.

When it is merely desired to collect all of the grit and organic material that settles in the grit chamber, an inclined scraper conveyor, in place of dewatering screw, is used for carrying the material out of sewage to point of discharge.

Installation views, layout drawing and specifications will be found in the new Folder 1942, sent to any interested reader on request.

Pneumatic Pavement Breaker

More powerful, lighter in weight, and incorporating the most recent advances in paving breaker design is the new No. 23 medium weight Paving Breaker just announced by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.

The No. 23 Paving Breaker can be used where handling ease is the main requirement, as the lighter weight makes it possible for the operator to handle the tool with greater speed and less fatigue and thus greatly increase output. It is designed for general demolition of all kinds—street and wall openings, asphalt cutting, digging, and on odd jobs of many kinds where only a single tool is needed. The "23" can also be fitted with a special head for driving spikes up to 12" long.

Additional information can be obtained by writing to the company for bulletin No. MC-3500.

Independent Pneumatic Paving Breaker.

YOU'LL BE THANKFUL YOUR POLICE HAVE *Motorola* 2-WAY RADIO COMMUNICATION

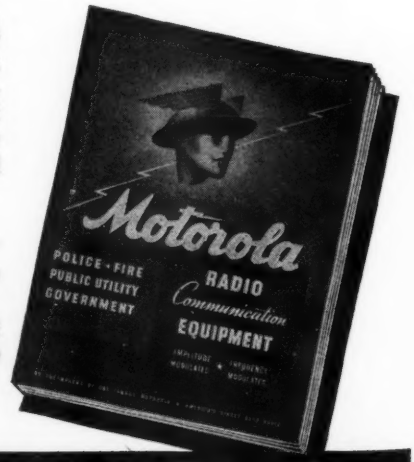
An auto horn blasts . . . brakes screech . . . a youngster's half muffled scream is hushed with a THUD! . . . A crumpled, little figure lies beneath a car.

Faint little heart beats whisper—"there's hope . . . there's a chance . . . but hurry . . . hurry." The police arrive in an instant. There's a quick examination. Over the police radio goes the call—"send a doctor . . . an ambulance . . . *but hurry . . . hurry . . . split seconds count* . . . a baby's life hangs in the balance." And so a child's life was saved—thanks to the far sighted public officials who fought—fought *hard* to get radio equipment for their police.

Today's experience proved their fight worth while. Their Motorola 2-Way Police Radio saved a life . . . and paid for itself.

Write For This Informative Booklet on 2-Way Radio Communication Systems

Every Public Official should have a copy of "Motorola Radio Communication Equipment." It contains valuable information on how cities and towns all over the country have solved their radio communication problems. Write for your copy today!



Motorola

FREQUENCY MODULATED ★ AMPLITUDE MODULATED ★

TWO-WAY RADIO COMMUNICATION EQUIPMENT

GALVIN MFG. CORPORATION ★ CHICAGO, ILL.

Readers' Service Department

These booklets are FREE. Use the coupon below or write the manufacturer direct, mentioning PUBLIC WORKS.

Construction Materials and Equipment

Asphaltic Limestone

5. Characteristics, methods of laying, and results with cold lay mixture shipped ready to use. Especially adapted to resurfacing old pavements, sealcoats and airport runways. Alabama Asphaltic Limestone Co., Liberty Nat. Life Bldg., Birmingham, Ala.

Cold Mix Plants

10. New catalog and prices of Portable Bituminous Mixers in 6 to 14 ft. sizes for resurfacing and maintenance. Issued by The Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½S to 56S sizes. The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Concreting in Winter

47. "Build Straight Through the Cold Weather Season" explains briefly how to obtain satisfactory winter concrete in less time. Write Michigan Alkali Co., 60 East 42nd St., New York, N. Y.

71. Modern Culvert Practice — a 72 page book containing valuable data and tables will be sent promptly to anyone interested in drainage by Gohi Culvert Mfrs., Inc., Newport, Ky.

72. "3 Answers to Limited Headroom," a comparison of three ways of providing safe strength and adequate drainage under limited headroom. For copy ask Armco Drainage Products Assn., Middletown, Ohio.

Generators

75. Homelite portable gasoline engine driven generators, both direct current and alternating current type, in sizes ranging from 500 watts output to 3,000 watts output, are fully described and illustrated in new folder. Homelite Corp., 2400 Riverdale Ave., Port Chester, N. Y.

Mud-Jack Method

107. How the Mud Jack Method for raising concrete curb, gutter, walls and street solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities — a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee, Wis.

Paving Materials, Bituminous

111. An excellent booklet issued by The Barrett Co., 40 Rector St., New York, N. Y., describes and illustrates the uses of each grade of Tarvia and Tarvialithic; 32 good illustrations.

Paving Materials, Brick

116. "New Developments in Brick Pavements." A review of the developments in brick pavements in recent years. Issued by the National Paving Brick Association, National Press Building, Washingon, D. C.

Pumps

121. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

122. CMC pump bulletin illustrates and describes complete line of modern centrifugals made in sizes from 1½" to 10" by Construction Machinery Co., Waterloo, Iowa.

123. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

124. 16-page illustrated bulletin, SP-37, describes and illustrates complete C. H. & E. line of self-priming centrifugal pumps from ½" to 8", including lightweight models for easy portability. C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

125. Homelite portable self-priming centrifugal pump, gasoline driven, in sizes from 1½" to 4", fully described and illustrated in new folder. Homelite Corp., 2400 Riverdale Ave., Port Chester, N. Y.

Retaining Walls

126. Charts showing the design of cellular or bin-type metal retaining walls, helpful suggestions on their use for stabilizing slopes, preventing stream encroachment, and solving problems of limited right of way, and construction details are given in a 16-page bulletin entitled, "ARMCO Bin-Type Retaining Walls." It is published by the Armco Drainage Products Association, Middletown, Ohio, and member companies. Ask for Bulletin H-37.

Road Building and Maintenance

127. See road work as it was done in the 1890's and as it can be done by a full line of this year's road building equipment. See, in this new action picture book, the first reversible roller, 1893 World's Fair Award Grader and how methods have changed. Attractive new booklet AD-1796 recently issued by The Austin-Western Road Machinery Co., Aurora, Ill.

128. Motor Patrol Graders for road maintenance, road widening and road building, a complete line offering choice of weight, power, final drive and special equipment to exactly fit the job. Action pictures and full details are in catalogs Nos. 253, 254 & 255, issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

129. New bulletins illustrate and describe the latest line of Littleford Utility Spray Tanks, Street Marking Units, Street Flushers and Kettles. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

130. Toro patching rollers, tractors and mowers for parks, airports, estates, highways and golf courses are pictured and detailed in new illustrated booklet available from Toro Mfg. Co., Minneapolis, Minn.

Rollers

133. New Tu-Ton roller of simple construction for use in rolling sidewalks along highways, playgrounds and other types of light rolling is fully described in a bulletin issued by C. H. & E. Mfg. Co., 3841 No. Palmer St., Milwaukee, Wis.

138. "The Buffalo-Springfield line of road rollers (tandem, 3-wheel, and 3-axle) are described in the latest catalog issued by the Buffalo-Springfield Roller Co., Springfield, Ohio."

139. "Ironeroller" 3 Axle Roller for extra smooth surfaces on all bituminous work. Booklet contains roller data and operation details. Hercules Co., Marion, Ohio.

Soil Stabilization

150. "High-Service, Low Cost Roads" is one of the newer booklets using an effective combination of picture and text to set forth the principals and advantages of road surface stabilization with calcium chloride. Complete, interesting and well illustrated. 34 pages. Sent by Solvay Sales Corp., 40 Rector St., New York, N. Y.

152. The Columbia Alkali Corporation, will be glad to furnish to anyone interested complete information dealing with Calcium Chloride Stabilized Roads. This literature contains many charts, tables and useful information and can be obtained by writing Columbia Alkali Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York City.

153. "Rock Salt for Stabilized Roads" is a handy, illustrated booklet telling how to construct and maintain salt-soil-stabilized roads. Sent on request by International Salt Co., Scranton, Pa.

154. "Soil Stabilization with Tarvia" —An illustrated booklet describing The steps in the stabilization of roadway soil with Tarvia will be mailed on request by The Barrett Company, 40 Rector St., New York, N. Y.

Tire Data

158. Handy pocket-size Goodyear Truck Tire Data Book contains load and inflation tables, dimenson data, factors governing mileage, for all types and sizes of truck, earthmoving and road grader tires. Also tables of weights and measures. Write Truck and Tractor Tire Div., Goodyear Tire & Rubber Co., Akron, O.

Tractors

159. "International Diesel TracTracTors" is a 48-page catalog giving full details of TracTracTors, including action pictures with bulldozers, bullgraders, blade graders, wheel scrapers, elevating graders, etc. Sent promptly by International Harvester Co., 180 North Michigan Ave., Chicago, Ill.

Street and Paving Maintenance

Asphalt Heaters

198. Illustrated Bulletins 15 to 20 describe Mohawk Oil Burning Torches; "Hotstuf" Tar and Asphalt Heaters: Portable Trailer Tool Boxes; Pouring Pots and other equipment for street and highway maintenance, roofing, pipe coating, water proofing, etc. Mohawk Asphalt Heater Co., Frankfort, N. Y.

199. Aeroil "Heet-Masters" for quick heating and melting of tar, pitch, asphalt, etc., with less fuel are illustrated and explained in new catalog No. 196W issued by Aeroil Burner Co., Inc. Box 599, West New York, N. J.

Dust Control

210. "How to Maintain Roads with Dowflake" is a new 58 page illustrated booklet of information on stabilized road construction. Includes specifications and several pages of reference tables from an engineer's notebook. Issued by Dow Chemical Co., Midland, Mich.

USE THIS COUPON

3-41

Readers Service Dept.
PUBLIC WORKS
310 East 45th St., NEW YORK

Please send me without obligation the following booklets listed in your READERS' SERVICE SECTION .....
(indicate by numbers)

Name .....

Occupation .....

Street .....

City ..... State .....

(Continued from page 54)

H. V. Robinson, Kirksville, Mo.
Ray G. Vollendorf, Monroe City, Mo.
Richard W. Halteman, St. Charles, Mo.
M. L. Evans, Hastings, Nebr.
Arthur Tuthill, for Little Ferry, Ridgefield Park, N. J.
Fred K. Derby, Scranton, Pa.
L. A. Rodenhiser, Midland, Tex.
Lloyd M. Schindler, Appleton, Wis.

The following are newly appointed City Managers:

Fred Farnsworth, Bangor, Me.
H. D. Eckler, Brewer, Me.
Ross E. Windom, Portsmouth, Ohio.

Water Works Superintendents recently appointed are:

N. C. Nutting, San Mateo, Calif.
George Lowe, Columbus, Ga.
Frank King, Alton, Ill.
Gary H. McNutt, McKeesport, Pa.
J. E. Dickson, Lenoir City, Tenn.

New County Engineers for 1941 include:

(Word following name of individual is name of county)

N. J. Webb, Apache, St. Johns, Ariz.
C. H. Band, Crittenden, Marion, Ark.
Rex E. Jally, Randolph, Pocahontas, Ark.
H. L. Fuller, Scott, Waldron, Ark.
Carl Wimken, Williamson, Marion, Ill.
Harry Hunter, Dearborn, Aurora, Ind.
W. M. Titers, Sherman, Goodland, Kan.
Conrad Schlegel, Rush, LaCrosse, Kan.
E. E. Larson, Douglas, Lawrence, Kan.
J. E. Watson, Meade, Meade, Kan.
S. J. E. Lucas, Oscoda, Mio, Mich.
J. Gilbert Denny, Clay, Liberty, Mo.
F. E. Tanner, Dawson, Lexington, Nebr.
Francis J. Campbell, Schenectady, Schenectady, N. Y.
C. C. Graber, Geauga, Chardon, Ohio.
L. C. Roush, Sandusky, Fremont, Ohio.
Clarence Nicholson, Jackson, Jackson, Ohio.
Chas. Snyder, Columbiana, Lisbon, Ohio.
Dwight Powell, Tillman, Frederick, Okla.
Sabert A. Hott, Grant, Medford, Okla.
John A. Chapman, Murray, Sulphur, Okla.
Samuel G. Mastriani, Lachanan, Scranton, Pa.
P. D. Gill, Jasper, Ridgeland, S. C.
Clarence C. Stephens, Custer, Rapid City, S. D.
Leroy Crigger, Marshall, Lewisburg, Tenn.
D. H. Hudder, Henry, Martinsville, Va.
Phillip Fordyce, Adams, Ritzville, Wash.
A. F. Taylor, Eastland County, Eastland, Tex.
O. Paul Lance, El Paso County, El Paso, Tex.
F. L. Dunn, Nottoway County, Crewe, Va.
J. T. Lay, Clallam County, Port Angeles, Wash.

Readers' Service Department

(Continued from page 63)

211. A complete booklet on dust control titled, "Dust Control and Road Stabilization," describes the use of Columbia Calcium Chloride for dust control purposes and stabilization of roads. Sent on request by Columbia Alkali Div., Pittsburgh Plate Glass Co., 30 Rockefeller Plaza, New York, N. Y.

212. "Are you Annoyed by Dust?" an illustrated circular telling how to prevent dust with calcium chloride. Sent free by Michigan Alkali Co., 60 East 42 St., New York, N. Y.

Sprayers

280. Cutback sprayers with new "single unit safety control" and full control of all spraying operations from the nozzle are described and illustrated in new bulletin No. 190 W issued by Aeroil Burner Co., Box 599, West New York, N. J.

Street Markers

300. Street marking simplified by the use of modern, self-contained units capable of handling any kind of striping jobs is the subject of an illustrated bulletin giving also full details of new M-B Street Markers. Sent by Meili-Blumberg Corp., Box PW, New Holstein, Wis.

Snow Fighting

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Features, specifications and method of attaching. Carl H. Frink, Mfr., Clayton, 1000 Islands, N. Y.

Ice Control

351. "Make Icy Highways Safe for Traffic"—a new bulletin by Michigan Alkali Co., 60 East 42 St., New York, N. Y., tells how to use calcium chloride for modern ice control.

352. "Rock Salt's 'Auger Action' makes it most effective for removing ice from roads and streets" is a new illustrated folder just issued by International Salt Co., Scranton, Pa.

Sanitary Engineering

Aero-Filter

356. New illustrated bulletin gives complete information on design of Aero-Filters to provide high-capacity, uniform, raindrop application over the entire filter bed. Write Lakeside Engineering Corp., 222 West Adams St., Chicago, Ill.

Air Release Valves

357. Automatic Air Release Valves for water, sewage and industrial uses are described and illustrated in new catalog issued by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

Analysis of Water

360. "Methods of Analyzing Water for Municipal and Industrial Use" is an excellent 94 page booklet with many useful tables and formulas. Sent on request by Solvay Sales Corp., 40 Rector St., New York, N. Y.

Activation and Aeration

376. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability. 20pp. illustrated. Sent on request to Norton Company, Worcester, Mass.

Cleaning Sewers

383. A 20-page booklet describes and illustrates a full line of sewer cleaning equipment—Rods, Root Cutters, Buckets, Nozzles and Flushers. Write W. H. Stewart (Pioneer Mfr. since 1901), Jacksonville, Fla., or P. O. Box 767, Syracuse, N. Y.

Diesel Engines

386. Write Dept. 118, Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago, Ill., for data on how the installation of F-M diesels has lowered taxes and made it possible for many communities to pay for their improvements out of municipal power plant earnings.

Feeders, Chlorine, Amonia and Chemical

387. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. % 96 Codding St., Providence, R. I.

Fire Hydrants

390. Specifications for standard AWWA fire hydrants with helpful instructions for ordering, installing, repairing, lengthening and using. Issued by M. & H. Valve & Fittings Co., Anniston, Ala.

391. See listing No. 410.

Gates, Valves, Hydrants

394. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Anniston, Ala.

395. Complete booklet with much worthwhile water works data describes fully Ludlow hydrants and valves. Sent on request. Ludlow Valve Mfg. Co., Troy, N. Y.

396. See listing No. 410.

Gauges

398. The full line of Simplex gauges for filtration plants are illustrated and described in catalog issued by Simplex Valve and Meter Co., 6750 Upland St., Philadelphia, Pa.

Hypochlorinators

400. New illustrated booklet W&T 357 describes this simple, inexpensive means of protecting small water supplies such as summer camps, hotels, swimming pools, dairies, etc., as well as for feeding chemical solutions in the water works plant. Contains typical installation sketches. Write "Wallace & Tiernan Co., Inc., Newark, N. J.

Manhole Covers and Inlets

402. Street, sewer and water castings in various styles, sizes and weights. Manhole covers, water meter covers, adjustable curb inlets, gutter crossing plates, valve and lamphole covers, ventilators, etc. Described in catalog issued by South Bend Foundry Co., Lafayette Boul. and Indiana Ave., South Bend, Ind.

Manhole Cover Silencers

403. New bulletin on Tapax for quickly ending noisy manhole covers and small sample free. Write Tapax Mfg. Co., 201 Hoyt Ave., Mamaroneck, N. Y.

Meters, Venturi

405. MS Meters for use with venturi tubes, flow nozzles, etc., in wall, panel, or floor mounting are covered in detail in catalog sent free by Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

406. New bulletin illustrates Builders Air Relay system of transmission for the Venturi Meter which is particularly useful for liquids containing suspended solids like sewage. Eliminates corroson, clogged pipes, etc. Write Builders Iron Foundry, Codding St., Providence, R. I.

Meters, Water

407. Complimentary bulletin W529 tells all about Pittsburgh IMO water meters, "the meters that wear in where others wear out." Write Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Pipe, Cast Iron

408. Handbook of Universal Cast Iron Pipe and Fittings, pocket size, 104 pages, illustrated, including 14 pages of useful reference tables and data. Sent by The Central Foundry Co., 386 Fourth Ave., New York, N. Y.

409. Cast iron pipe and fittings for water, gas, sewer and industrial service. Super-deLavaud centrifugally-cast and pit-cast pipe. Bell-and-spigot, U. S. Joint, flanged or flexible joints can be furnished to suit requirements. Write U. S. Pipe and Foundry Co., Burlington, N. J.

410. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., 400 Chestnut St., Philadelphia, Pa.

Pipe Forms

411. Making concrete pipe on the job to give employment at home is the subject of a new booklet just issued by Quinn Wire and Iron Works, 1621 Twelfth St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms. Sent promptly on request.

Pipe, Reinforced Concrete

412. Literature describing the manufacture and installaton of Lock Joint Reinforced Concrete Pressure Pipe for water supply lines and sewer force mains. Lock Joint Pipe Co., Ampere, N. J.

Pipe, Transite

413. Two new illustrated booklets, "Tansite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., 22 East 40th St., New York, N. Y.

Pipe Joints, Sewer

415. How to make a perfect sewer pipe joint—tight, prevents roots entering sewer, keeps lengths perfectly aligned; can be laid with water in trench or pipe. General instructions issued by L. A. Weston, Adams, Mass.

Pumps and Well Water Systems

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklets. Advertising Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis, Tenn.

Meter Setting and Testing

430. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Sand Expansion Indicator

432. New bulletin gives full details of Simplex Sand Expansion Indicators for water plants. Write Simplex Valve & Meter Co., 6750 Upland St., Philadelphia, Pa.

Steel Sheet Piling

435. Steel sheet piling to speed sewer jobs is covered in illustrated catalog containing complete production specifications. Write Dept. PW-2, The Union Metal Mfg. Co., Canton, Ohio.

436. "ARMCO Sewers" is the title of a 48-page booklet describing the structural and other advantages of ARMCO Ingot Iron. Paved Invert and Asbestos-Bonded pipe for storm and sanitary sewers. Design data and large charts will be found helpful by engineers engaged in the design or construction of sewers. Copies will be sent on request by the Armco Drainage Products Association, Middletown, Ohio, or its associated member companies.

437. "Metal Sheeting for Lower Average Job Costs" is a new bulletin about light weight sheeting you can use again and again. Issued by Armco Drainage Products Assn., Middletown, Ohio.

Septic Tanks, Small

438. Septic Disposal Systems, Waterless Toilets, Multiple Toilets for Camps and Resorts, and other products for providing safer sewage disposal for unsewered areas are described and illustrated in data sheets issued by San-Equip Inc., 504 E. Glen St., Syracuse, N. Y.

Sludge Drying and Incineration

440. "Disposal of Municipal Refuse." Complete specifications and description including suggested form of proposal; form of guarantees; statements and approval sheet for comparing bids with diagramatic outline of various plant designs. 48 pages. Address: Morse Boulger Destructor Co., 216-P East 45th St., New York, N. Y.

441. Full information about Nichols modern, efficient gabage and refuse incinerators now available in the Basket Grate, Continuous Grate, Revolving Grate and Monohearth types will be sent promptly by Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

442. Recuperator tubes made from Silicon Carbide and "Fireclay" Corebusters for maximum efficiency are described and illustrated in bulletin No. 11 issued by Fitch Recuperator Co., Plainfield National Bank Bldg., Plainfield, N. J.

443. Nichols Herreshoff incinerator for complete disposal of sewage solids and industrial wastes — a new booklet illustrates and explains how this Nichols incinerator works. Pictures recent installations. Write Nichols Engineering and Research Corp., 60 Wall Tower, New York, N. Y.

Swimming Pools

446. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

447. 40-page Manual on swimming pools. Includes swimming and pool layouts, specifications, etc., and details concerning Permutit Swimming Pool Equipment. Write The Permutit Co., Dept. G-4, 330 West 42 St., New York, N. Y.

Taste and Odor Control

450. Technical pub. No. 207 issued by Wallace & Tiernan Co., Inc., Newark, N. J., describes in detail taste and odor control of water with BREAK-POINT Chlorination, a method of discovering the point at which many causes of taste may be removed by chlorination with little or no increase in residual chlorine. Sent free to any operator requesting it.

Treatment

453. "Safe Sanitation for a Nation," an interesting booklet containing thumbnail descriptions of the different pieces of P.F.T. equipment for sewage treatment. Includes photos of various installations and complete list of literature available from this company. Write Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill.

455. New booklet (No. 1642 on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures; drawings of installations, sanitary engineering data and design details. Link-Belt Company, 2045 W. Hunting Park Ave., Philadelphia.

456. New 16-page illustrated catalog No. 1742 on Straightline Collectors for the efficient, continuous removal of sludge from rectangular tanks at sewarage and water plants. Contains layout drawings, installation pictures, and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia, Pa.

457. New illustrated folder (1942) on Straightline apparatus for the removal and washing of grit and detritus from rectangular grit chambers. Address: Link-Belt Co., 2045 W. Hunting Park Ave., Philadelphia, Pa.

458. "Sedimentation with Dorr Clarifiers" is a complete 36-page illustrated catalog with useful design data. Ask The Dorr Company, 570 Lexington Ave., New York, N. Y.

459. A combination mechanical clarifier and mechanical digester, The Dorr Clarigester, is explained and illustrated in a bulletin issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

460. This new 145 page illustrated chemical products book contains 55 pages of Tables, Factors and valuable Reference Data. Issued by General Chemical Co., 40 Rector St., New York, N. Y.

461. Preflocculation without chemicals with the Dorrco Clariflocculator in a single structure is the subject of a new booklet issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

462. Dorrco Monorake for existing rectangular sedimentation tanks, open or closed, is described and illustrated in a new catalog sent on request. The Dorr Co., 570 Lexington Ave., New York, N. Y.

Tunnel Liners

480. "Save Money with Armco *Light Duty* Tunnel Liner" is a bulletin you'll want if you are interested in economical, long lasting tunnels. Write Armco Drainage Products Assn., Middletown, Ohio.

Valves (See Gates, Air Release, etc.)

Water Works Operating Practices

490. "Important Factors in Coagulation" is an excellent review with bibliography and outlines of latest work done in the field. Written by Burton W. Graham and sent free on request to Activated Alum Corp., Curtis Bay, Baltimore, Md.

491. "Soft Water for Your Community" tells by means of many interesting pictures and text the advantages of soft water to any community. Ask for a copy from The Permutit Co., Dept. G4, 330 West 42nd St., New York, N. Y.

492. "Alkalies and Chlorine in the treatment of Municipal and Industrial Water" is a new comprehensive survey filled with tables, charts, cost comparisons, etc., valuable to all who treat large volumes of water. Write Solvay Sales Corp., 40 Rector Street, New York City.

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